

~~THE OYSTER CULTURE - 1899~~

THE OYSTER FISHERIES

OF

CANADA

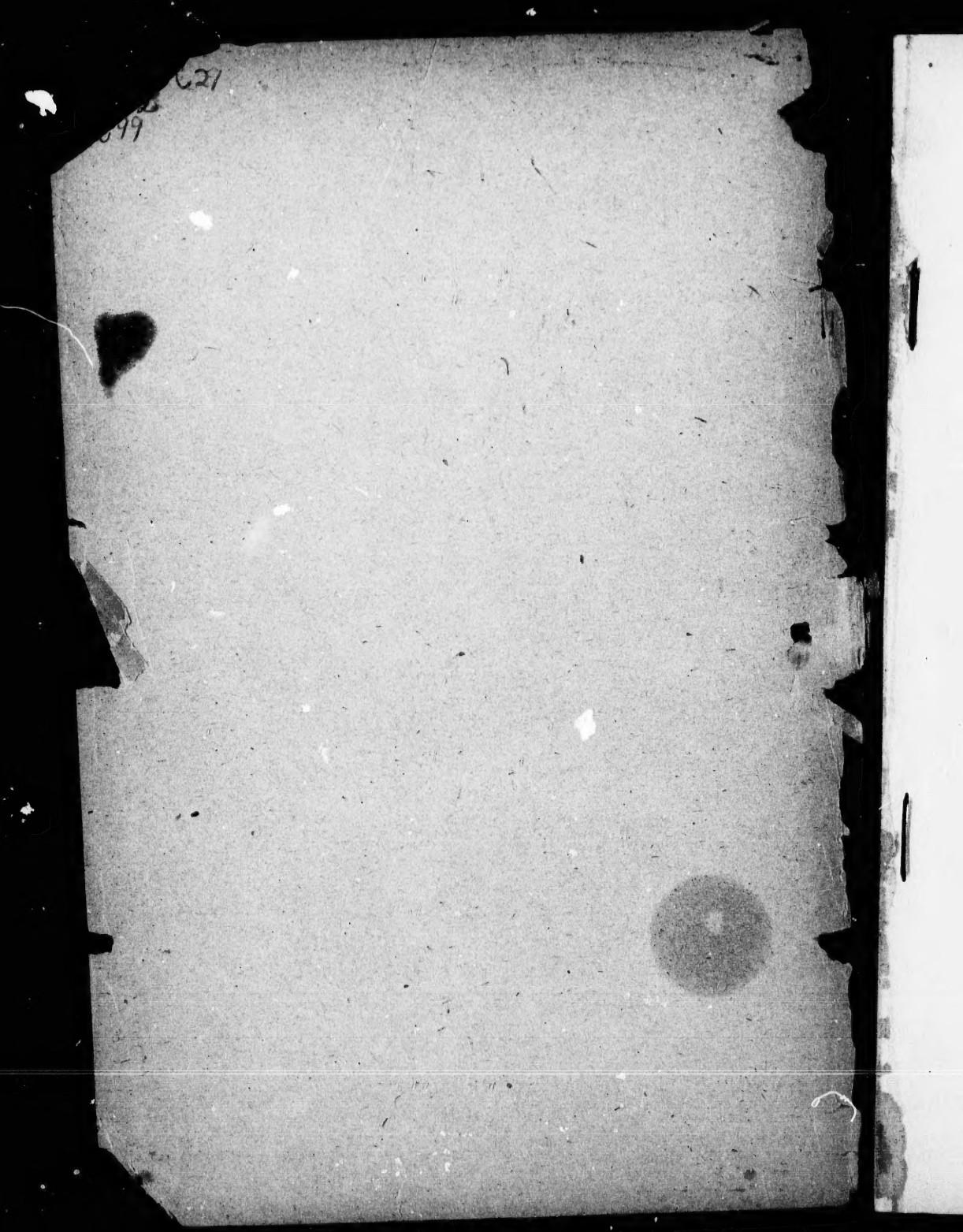
A SURVEY AND PRACTICAL GUIDE ON OYSTER CULTURE

BY

MR. ERNEST KEMP
Oyster Expert

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OTTAWA
GOVERNMENT PRINTING BUREAU
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FISH CULTURE BRANCH
DEPARTMENT OF FISHERIES

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FISH CULTURE BRANCH
DEPARTMENT OF FISHERIES

CONTENTS

	Page.
Introduction	1
Description of the Oyster.....	2
Depletion and its causes.....	2
Notes of New Brunswick, from Annual Reports.....	2
Notes of Prince Edward Island, from Annual Reports.....	5
Notes of Nova Scotia, from Annual Reports.....	27
Notes of British Columbia, from Annual Reports.....	28
Report on the Oyster Fisheries of Canada.....	29
Additional remarks on the Oyster Fisheries of Canada.....	32
The Oyster Fishery, its condition and restoration considered, from Deputy Minister's reports.....	35
Oyster Culture in England—The Whitstable Oyster Company	50
Extract of Professor Bashford Dean's report on European methods.....	53
Essex Oyster Grounds.....	54
Oyster Culture in France.....	55
Oyster Culture in Holland.....	58
Oyster Culture in Italy.....	59
Oyster Culture in United States.....	64
Methods used in Connecticut.....	66
Oyster Industry in New York.....	69
Oyster laws of New York.....	70
Extract on Close Season.....	71
Unnecessary Destruction of Young Oysters.....	72
Oyster Planting	73
Private Culture	73
Results of Leasing Areas.....	74
The Fishery and its effects.....	74
Information given by Oystermen.....	75
Canadian Oyster Industry.....	75
Application for Oyster Fishing Privileges.....	78
Oyster Dredges	81
The Soil	82
Temperature of the water.....	84
Close season	84
Peculiarities in the Breeding of Oysters	85
Oyster Food	88
Enemies of the Oyster.....	88
Fivefingers or Star-fishes	89
Sea Urchins	89
Dogwhelks	90
Seaweed	90
Seaworms	90
Sand	90
Mussels	91
Mud Digging	91
Effect of Mussel Mud.....	92
Quantities and Value of Oysters caught in the Dominion since 1876.....	95
Oyster Culture Operations for year 1898—	
Richmond Bay, P.E.I.....	96
Tracadie, N.S.....	98
Closing Public Areas.....	98
Private Areas	98
Oyster Areas of the Provinces.....	99
Oyster Fishing—Its methods.....	100
Mud-digging Areas	101
Size Limit	101

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REPORT
ON
CANADIAN OYSTER FISHERIES
AND
OYSTER CULTURE

BY
ERNEST KEMP,
Oyster Expert, Department of Marine and Fisheries.

The Department of Marine and Fisheries have, from time to time, received various reports on oyster culture, written by officials, which have either been printed in the annual reports, or recorded on file; but what is really required by the oyster culturists of this Dominion is a "practical guide," to assist them in their undertakings in maintaining a supply of oysters on their own grounds, to grow them successfully, and by care, industry and attention, to increase the supply, with the object in view of sending oysters to the markets superior to those obtained on the natural beds. The practical cultivation of oysters is successfully carried on in the United States, France, Great Britain, Holland and other countries.

The most effectual means will doubtless be adopted by the several countries. As an officer of the department, with the long practical experience I have had, and by collecting what material I can, for the purpose of assisting and instructing those interested in the cultivation of oysters, I have compiled the following general sketch and guide upon the subject. There is one thing that has to be borne in mind in the Dominion, and that is the length and severity of the winter; a great many persons are under the impression that oysters can be cultivated here on a very large scale, artificially, as in other countries where the temperature is not so low as it is here, and which I will explain later on. Natural oyster areas are found from Caraquette Harbour, in Gloucester County, New Brunswick, following the shores down along the Nova Scotia coast as far as the entrance of the Strait of Canso, the greater part of Prince Edward Island, and Cape Breton, with the rivers and creeks adjoining, altogether comprising a considerable area of oyster beds, or what might be converted into beds by labour and patience, in the maritime provinces. Another species of oyster, viz., *ostrea lurida*, is in British Columbia, but up to the present time very little attention has been given to their culture, and it is to the former areas that I principally allude. It is in those waters where oysters have been, and are still growing that attention should be directed, to protect the public beds from utter destruction, and where oysters could be successfully cultivated by private individuals or companies, as the case may be.

O. C.—I

In the first place, the question arises, what is an oyster? It is found widespread in the world. For food purposes, oysters are much sought after, and were well known in the remote past. They are of excessive fecundity where suitable soil exists, and attain their full growth between three and four years. The demand has now grown to such an extent that it is greater than the supply. This is a well-known fact by every one in any way connected with or near the sea, and the requirement is such that the bivalve is now being carried far inland, that it would be a difficult matter to find any one who really does not know what an oyster is, but it may be briefly described as a succulent edible mollusk or shell-fish. Its shell is double, or consists of two valves which can be opened or closed by means of the adductor muscle. In the cockle, the clam and mussel, there are two adductors, but in the oyster only one. In the adult state the oyster is fixed and adheres to the surface on which it rests. The right valve is flat, and is smaller and thinner than the left, and in a corresponding manner the right side of the oyster's fleshy body is more developed than the left, and so far it departs from the bilateral symmetry of the class to which the oyster belongs. In our Canadian oyster the sexes are separate, eggs being produced in certain individuals and sperms in other individuals. In the European oyster, eggs and sperms are produced in the same individual, and the life of the embryo and the developed larval oyster considerably differs in the two kinds (the Atlantic and European oyster).

DEPLETION AND ITS CAUSES.

The causes of the depletion of Canadian oysters are many, and on referring to the annual reports we can at once see the recklessness with which both oysters and areas have had to contend. Oysters were taken, until a very recent date, all the year round, and of all sizes. During the fishing season, oysters were caught irrespective of size, but as those could not all be sent into the market, the small were culled out, and thrown up in piles to rot. This method was a case of wholesale slaughter, more oysters being destroyed than were actually sent into the market. As they were not nearly full grown, the result was heavy losses to the beds, which, of course, eventually seriously affected the obtaining of any considerable quantity of spat. The beds have also suffered considerably on account of being fished during the winter months through the ice, the large ones being culled out, the small ones left on the ice to perish with the frost and cold.

Another evil to which the Canadian oyster beds have been subject, and, so far as I know, it does not exist elsewhere, is the system of mud-digging. To show the extent of this, and other depredations, so injurious to the propagation of the oyster, the following extracts from the annual reports are given. They fully explain the abuse the oyster industry has received at the hands of fishermen, farmers and others; also, some very valuable hints and advice, which, if carried out, would greatly assist in reviving many of the depleted beds and unworked areas. There are some extracts taken from the Deputy Minister's report, showing what action, from time to time, has been taken in the matter by the department. The reports are classed according to provinces. As early as 1868, and even previous to that date, suggestions were made, and experiments tried by different persons interested in oyster culture, therefore the reports are from that time onward:—

NEW BRUNSWICK.

In the annual report for 1868, pages 64 and 65, the Hon. J. Ferguson, of Bathurst, states as follows:

"That four thousand barrels of oysters are shipped from the Caraquette beds annually to Quebec and Montreal. The oyster beds are not as productive as formerly, and, with a view to their preservation, are not allowed to be taken between 1st June and 1st September. My impression is that the grounds should be laid off in lots and fished alternately, and a fine imposed on persons selling undersized oysters. This could be effected by the supervision of a warden authorized to visit the grounds during the oyster season in September and October, when vessels are loading."

Inspector Venning, in his report of 1871, page 131, points out the necessity of some action being carried into effect to protect the beds and develop the industry, as follows :

" On the subject of the restoration of the oyster beds in New Brunswick, and the adoption of some means by which the production of this mollusk may be increased, both in New Brunswick and Nova Scotia, by planting new beds in localities favourable to their growth, I have in former reports said so much that I know not what further to say. The close time provided by law has been rigidly enforced, but excessive and indiscriminate raking of the same beds during the whole open season, year after year, not only prevents any increase, but must necessarily, steadily and surely, exhaust them, and if some more effectual means are not adopted, every known bed in the province will soon be destroyed. The simplest, wisest and most effective means of increasing the production of oysters in New Brunswick and Nova Scotia is to lease all localities favourable to their growth (whether old beds exist there or not) on such terms as will induce practical men to invest capital in their cultivation. This is the means adopted in other countries, and no other will, in my opinion, ever succeed to any extent, because, so long as natural beds are common property, they will be raked just as often and as long as any oysters can be found to rake. The protection provided by the Fisheries Act has now been applied for four years, and the result is nil—in fact, the beds are worse by just so many barrels as have been taken from them, until they are now not worth raking in most places where they were formerly abundant. These remarks apply more particularly to Shediac, Cocagne, Buctouche and Richibucto, but, in other localities, the same causes are fast producing the same results, for it is plain that no locality can stand this constant and unremitting drain, by primitive and clumsy implements, the use of which destroys as many oysters as are raised by them. To have any fair chance to increase, the beds should be raked but once every three or four years, and, in the intervals, they should not be disturbed; but, of course, those who have no particular interest in them care only for the present, utterly regardless of the future. Next to leasing, the most effectual mode of securing an increase in existing beds, will be setting them apart for a number of years—say twelve or fifteen—and prohibiting all disturbance of them during that time. If none of these methods are adopted, a few years will see the last of the very best oysters in the world. In this connection, I may state that the operations of Hon. A. Macfarlane, in Malagash Bay, Colchester County, bid fair to be entirely successful. He has already planted new beds, and the young oysters are growing rapidly, proving beyond a doubt that oysters can be cultivated on our coasts with as much certainty as a crop of grain can be sown and gathered. Considering the growing demand for this delicious luxury, and the large markets that will be open for it when the Intercolonial Railroad is completed, it is a subject of great regret that our unrivalled facilities for oyster production to any desired extent should not at once be utilized, by the adoption of any and all means which will secure the result. At present the existing beds are a source of profit to no one, and there is no reasonable prospect, under the present system, of their ever becoming such; on the contrary, there is an absolute certainty that their total extinction is not far distant. I respectfully urge the reconsideration of this matter, and the adoption of some means by which this valuable resource may be preserved and developed."

*From annual report, 1878, page 253.**

Oyster Fishery.—With respect to this once valuable fishery, I can only repeat the oft-told tale of its rapidly approaching extinction. The beds that now remain yield but small returns for excessive and laborious raking. This yield is every year becoming less, and the size smaller. The close time affords no adequate protection, because the constant raking of the beds prevents the growth of the young. There is no system, care, or thought for the future. Nothing but blind and ignorant labour, year after year, in raking the nearly exhausted beds.

As no effort at artificial culture has yet been made, and as none of the beds are allowed the rest necessary for their recuperation, the total extinction of all is inevitable, and not far distant. The only protective measure I can now suggest is a compulsory rest for several years, and after that, stringent regulations for the proper working of the

*By Inspector Venning.

beds in such rotation as will permit the fish to multiply and the young to attain maturity."

*From annual report, 1883, page 71 :--**

"The demand for oysters and the good prices obtained have stimulated production everywhere, and the depleted beds are now raked more industriously than ever. Like the 'tailings' of the gold diggings, something can yet be tortured out of some of them; but these very efforts to meet the demand shut the door against all hope of any improvement from natural increase. In Westmorland, where the largest supplies were formerly obtained, the increased demand and improved prices have failed to produce an increased yield, which clearly shows that these once prolific beds are now exhausted. Over-fishing and indiscriminate raking have done their work very effectually. Oyster culture by private enterprise is the only means by which an increased supply can now be obtained."

*From annual report, 1885, pages 147 and 156 :--**

"The great demand for this mollusk, and the high prices offered, have so stimulated production that the returns show a considerable increase in the quantity raked. This increase comes entirely from the beds in Northumberland, which have hitherto not been so persistently raked, because the quality of the oyster is inferior to those of Kent and Westmorland, where the beds are now nearly exhausted. As long as these beds would pay for raking, those in Miramichi bays were left comparatively undisturbed, except by residents for local use. But now, when all other beds are exhausted, vessels from all parts of the province, and even from Quebec, flock to these, and rake them without cessation, from the opening to the close of the season. I cannot too strongly urge some regulations which will save from destruction the only oyster beds left in the province. It is very desirable that some inducement should be held out to introduce the system of oyster culture now pursued in the neighbouring States. Every facility should be given to private enterprise to make oyster planting successful, for only in this way will the demand ever be supplied. Several applications have been made, and are now on file in the department, for lease of certain defined limits within which to cultivate oysters. For these I would respectfully urge your favourable consideration.

"The only oyster beds in the province that will now repay the labour of raking, are those in Miramichi Bay and River. These are being destroyed as fast as ignorant cupidity and selfish greed can accomplish this end. There are absolutely no regulations to prevent this being done, and consequently fishery officers can only look on and see the work of extermination progress. It is very desirable that these beds be saved from destruction, and if this can be done in no other way, I would recommend that they be leased to responsible parties, who will rake them judiciously and keep them productive. Any measure that will prolong their existence will be acceptable to the people of the county, who are most interested in them, and infinitely preferable to the present absence of any protection.

Overseer Williston, of Bay du Vin district, reports :

"A great increase in the number of vessels raking oysters in the bay, and strongly recommends some regulations to prevent their destruction from excessive raking. He says : 'It is hard for our people, who have pleaded for the protection of the only oysters left in the province, to see these vessels covering the beds and raking indiscriminately, without order or method, intent only on grabbing all they can, and feel that they are powerless to prevent the destruction. These vessels bring their own crews and supplies, employ no local labour, pay no taxes or license fees, contribute nothing to the revenue, and leave exhausted and ruined beds behind them. It is safe to say that, by their rude and wasteful method of raking they destroy as many oysters as they raise. It would be better to lease the beds to those who would rake them fairly, and keep them productive, than to have them thus recklessly destroyed by strangers, who have no interest in them, except what they can get in the general game of grab.'

*By Inspector Venning.

*From annual report, 1887, page 143 :**

"The failing beds of Caraquet and Bay du Vin have furnished almost the whole catch of 23,196 barrels. All the oyster men formerly scattered over the beds of Shemogue, Shediac, Cocagne, Buctouche and Richibucto now flock to the only beds that will repay raking. How much longer they will do so under this excessive working will very soon be decided. It is much to be hoped that the Commission appointed last summer to inquire into and report on the lobster and oyster fisheries of the maritime provinces will recommend some practical measure to save these once valuable sources of profitable industry from final destruction.

The oyster beds continue to be raked excessively during the whole open season, and now winter raking through the ice has been commenced on a large scale, which will hasten the destruction of these, the only remaining beds in the province that are not practically exhausted.

*From annual report, 1888, page 97 :**

"The catch of oysters is less than that of last year by 6,812 barrels. Nearly the whole catch of 16,334 barrels came from the beds of Gloucester and Northumberland. Those of Kent and Westmorland, which formerly were said to be inexhaustible, are now nearly extinct. Kent County produced this year from all her beds in St. Louis, Richibucto, Buctouche and Cocagne, but 2,000 barrels, while all the beds in Westmorland have yielded only 106 barrels. As most of the oyster farmers now concentrate their operations on the Gloucester and Northumberland beds, these are being exhausted faster than ever. How much longer these will pay for raking remains to be seen; but unless some comprehensive measure of protection is applied, the time must be very short. For twenty-one years I have been urging protection for our oyster beds; but their destruction has gone steadily on; year after year has passed without a single step being taken to prevent indiscriminate raking and wanton waste."

PRINCE EDWARD ISLAND.

The following are some extracts taken from the annual report of 1873, page 197, written by the late Hon. W. H. Pope, and others :—

"Oysters have flourished in every tidal river and bay in Prince Edward Island. At the present time, productive oyster beds are found in Richmond, Cascumpec and Hillsborough bays, and in the rivers flowing into these inland waters. I might almost say in these localities alone. Oysters are fished with "tongs" in depths varying from three or four feet to twelve, and even fifteen feet. It is scarcely practicable to fish oysters with tongs at a greater depth than fifteen feet."

"During the past ten or twelve years, millions of tons of oyster shells and mud have been taken up by our farmers, from oyster beds, by means of dredging machines, worked by horses on the ice. In many instances the beds have been cut through, and in some places the deposits of shells have been found to be upwards of twenty feet in thickness. It is probable that many of the oyster beds ceased to be productive of oysters ages before the settlement of the country by Europeans. Extensive deposits of oyster shells are now found covered by several feet of silt. How were the oysters upon these beds destroyed? The natural process of reproduction and decay would cause the oyster beds formed on the bottom to rise so near to the surface of the water, that the ice would rest on them. The weight of heavy masses of ice upon the beds would injure the oysters, and the moving of the ice, when forced by tide or wind across the bed, would soon destroy them. I have observed the more elevated portions of an oyster bed, over which ice had been thus forced. Several inches of the surface of the bed, including all the living oysters, had been driven before the ice, and the shells and oysters so removed, had been deposited in a miniature moraine on the slope of the bed, where the water was sufficiently deep to allow the ice to pass over it. This crushing and grinding process would destroy many of the oysters; some would be crushed and broken, others smothered in the moraine. The

*By Inspector Venning.

gradual silting up of the river would prevent the running of the ice, and the oyster beds would, in time, be covered, as we now find them. Deposits of oyster shells (covered with mud), twenty feet in depth, are found in rivers, in the deepest parts of which there are not now fourteen feet of water."

"Oysters thrive on muddy bottoms, but they will not live if imbedded in mud; many oyster beds have been destroyed by mud alone. The annual fishing of oyster beds, if not carried to excess, improves them. In the process of fishing, the surface of the bed is broken up, the shells and oysters lifted out of the mud, and a supply of material (cuijch) afforded such as the oyster *spat* requires, and without which it must perish."

"Oysters upon natural beds are seldom, if ever, killed by frost. I have known oysters to thrive upon a hard stony bottom, notwithstanding that the ice rested upon them once in every twenty-four hours throughout the winter. Some of these oysters grew adherent to a small flat rock about eight inches in thickness. The oysters on the top of the rock were killed when they attained their second year's growth, I think, by pressure, as those on its edges were never injured by ice or cold."

"Oyster beds in rivers in which saw-dust is thrown in large quantities would probably be injured by it. The saw-dust would, I think, be carried by the current over the beds, and the roughness of their surfaces would detain some of it. The interstices between the shells and oysters would probably become filled with saw-dust and mud. Mud and decomposing saw-dust constitute a most offensive compound."

"The area of productive oyster beds in the Dominion is comparatively limited, and altogether inadequate to supply the demand for oysters which is now enormous, and which is increasing every year. Unless the existing beds be protected and improved, and new beds formed, the day will soon come when the oyster beds of the Dominion will cease to produce. Our neighbours of the United States tell us that Virginia alone possesses more than one-and-a-half millions of acres of oyster beds, and, notwithstanding the fact that oysters increase much more rapidly in the warmer waters of Virginia than they do in this latitude, the authorities of that State have expressed their fears that the oyster beds of Virginia, if left open to the world, and dredged at all seasons of the year, will become extinct."

"The rivers and estuaries of this island are admirably adapted for the cultivation of oysters. The oysters found in its bays are not to be excelled in flavour, and if fished late in autumn they will keep good for months. I see no reason why hundreds of thousands of acres of oyster beds should not be formed in these bays, which would produce vast quantities of oysters in quality much superior to the oysters of Virginia. The material for the formation of such beds is at hand in the ancient ones; and oysters with which to sow them could be had at little cost during the warm calm days of summer."

"We have a 'close season,' from June until September, but the law prohibiting fishing during this season is openly violated. Oysters are caught and exposed for sale in every month in the year, and salmon are destroyed upon their spawning beds with the utmost impunity. I shall be happy to hear that the Dominion Government have resolved to enforce the laws for the protection of oysters, salmon and trout. We now form part of the Dominion, as you know, and have a right to look for wiser legislation and a better administration of law."

"Do you think oysters would thrive in somewhat deeper water than that in which they are now found, if sown there? I think they would thrive in the deepest part of any inland water, if placed upon suitable ground."

Mr. Pope expresses the hope that the Minister of Marine and Fisheries will think proper to appoint a commission to report upon the oysters and oyster fisheries of the island, and intimates that in such an event he would have no objection to give his services gratuitously."

"Many once productive beds, in various parts of the Gulf, now yield almost nothing; and there is too much reason to fear that unless precautionary measures are adopted, the oyster fisheries of the eastern part of the Dominion will soon become a thing of the past. The raking of the beds has been palpably excessive and wasteful; no such thing as cleansing the ground and scattering the *spat* during the close season has ever been practised; the pollution of the grounds by refuse of mills, by silting up, and a variety of

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other causes, had led to the present state of ruin and decay which we now see. Neglect, waste, and excessive cupidity have almost destroyed these oyster beds, and will ultimately entirely do so unless remedial measures are adopted."

*From annual report, 1879, page 268 : **

"From some reason of demand and supply, the oyster fishery has scarcely been prosecuted this year with the usual vigour, consequently the returns are not in excess. Prices have ruled low, thus discouraging the industry. There is no special feature to report. A good deal of poaching took place in the east and west of Queen's County, Richmond Bay, in Prince County, and elsewhere where there are no wardens. Such measures of repression were taken as the circumstances permitted. Some thieving also took place from private oyster beds, which depredations were promptly checked."

"The abundance of eels in the vicinity of some of the spawning beds is believed to be very detrimental to the increase. Storms last fall and this spring did some damage by silting over the beds, but not to an extent to affect the fishery."

"The digging of 'mussel mud' for manure—mussel mud being the shells of old oyster beds—is very harmful to the live beds, but it is scarcely to be doubted that the benefit to the county is of more absolute value than the preservation of the oysters. Deep holes are excavated in the bed of the oyster grounds and the spawn washed into these holes is silted over and perishes. The local law expressly protects diggers of such manure from damages if live oysters are taken. Custom has established that inlets, even on the frontage of farms, are free to all, although an eminent authority, the late Judge Pope, of this province, freely expressed a different opinion. Were a test case established in the courts that the oyster beds, old and new, on the frontage of farms belong to the owners of the shore, better regulations would be adopted, yet outsiders be still permitted to procure manure on payment of a small royalty. Such a regulation once established would materially assist in preserving the live beds."

"In connection with shell-fish it may be referred to as odd that none of our enterprising employers of fishermen have yet established a mussel-farm for bait, such as those of the Bay of Aiguillon, France, neither has any oyster-grower adopted the plan of the oyster *plat*s of the Ille de Ré, nor any person fitted up an ice-house for the preservation of bait."

*From annual report, 1880, page 239 : **

"Illegal oyster fishing causes considerable trouble. Any person (excepting the fishery officers) can procure oysters in Charlottetown and some other places at any time throughout the close season. The general public appear incapable of believing that during close time shell-fish are unfit for food. Wherever there is demand there will be supply, and as the restaurants are besought for oysters even during the hot days in summer, they manage to minister to the depraved taste of their customers. I was in hopes that the appointment of a special warden for Charlottetown would prevent supplies being smuggled to the receivers in town, but as it somehow has not answered the purpose, other arrangements will be required for next year.

"Although it is to be hoped, even for hygienic reasons, that the vicious propensity of eating unclean shell-fish may be educated out, there is a more destructive agency to the oyster fishery in 'mussel mudding,' or the taking of oyster shells for lime. As matters at present stand, the almost complete extinction of oysters in Prince Edward Island is only a question of time, and, unless circumstances altogether hostile can be reconciled, that time will be a short one. At present it is a tussle between the farmer and fishmonger, and the weaker will go to the wall. Let me take some pains to make this clearly understood by the department.

"The soil of almost the whole province of Prince Edward Island is a light loam from disintegrated new red sandstone, so deficient in lime as not to effervesce with acids. There is no limestone to speak of. Crude stone for the few lime kilns at present burning has to be imported from Nova Scotia, New Brunswick and Anticosti. Agricultural lime is, however, an absolute necessity. Hence the immense value to the farmer of

*Inspector J. Hunter Duvar.

what is known as 'mussel mud,' that is, the shells and marine deposits of old oyster beds, which supply a large percentage of the purest lime, the remainder being animal matter and marine alluvium, themselves valuable fertilisers. It is not saying too much to assert that the product of grass and grain has been increased one-third by the use of this mud during the few years since it began to be generally made use of. Twenty, not exceeding thirty, sleigh loads is the quantity used per acre. Last year the bulk extracted from the oyster beds could not have been less than 200,000 loads, at a rough calculation, and as it is now conveyed inland by railway, the demand is vastly increasing. During the season of winter the cumbrous digging machines, worked by horse-power, and each attended by two or three men, cover the oyster creeks like a scattered encampment.

"The island coast is fringed by innumerable creeks—our so-called river mouths—over beds of sand, paved with patches of broken sandstone or with an alluvial mud, not soft enough to be called ooze. Many miniature bays present the like conditions. From time immemorial oysters have propagated on these floors. Like the coral worm the bivalves are continually building up reefs. The tides covering these oyster reefs have no rapid rise or fall to wash the spat out to sea, the medium rise on the gulf being about three feet, and on the Straits of Northumberland not very much more in the sheltered coves. Geological indications testify that many of the creeks and inlets were formerly deeper and narrower than they are now. Stratum on stratum of oysters grew in them, the underlying layers dying in the ordinary course of decay, each as it died forming a bed for its successor. On each stratum grew other strata intermingled with drift continually growing higher until the reef reached into the region of the ice, when, of course, the surface stratum, then the only one alive, perished. It is this "midden" of mingled oyster shells and muck that is called a mussel mud bed. Live beds are undergoing the same process of decay and growth, and are continually increasing in height, although yet below the level at which they come in contact with the rasping of drift ice. Over these beds, alive and dead, the digging machines are erected, and cut deep sections in the banks of shells.

"It will be seen that without the added destruction of the mud-diggers every oyster bed will perish naturally in process of time, but new beds would form in an ever enlarging radius, if left undisturbed. In three or, at most, four years from the time the floating spawn fixes itself in a new locality, full grown oysters are to be found.

"Prior to confederation a good deal of tinkering was done by local legislation in regard to oysters. In the time of William the Fourth an Act was passed to prevent the practice of burning live oysters for lime. I am under the impression that at one time export was prohibited for a period of three years. By another Act all persons, except resident islanders, were forbidden to fish, under pain of fine and forfeiture. In 1865, regulations were made for leasing, by auction, certain localities laid off as public preserves, and persons owning creek lands were encouraged to apply for a grant of their water frontages for oyster culture. So far, so well. But next session an Act, remarkable for its crudity of expression and disregard of statute rights, was passed containing this clause: 'Nothing shall prejudice the right of any person to take from any river, whether within the bounds of any oyster fishery which shall have been or may be granted or otherwise, any mud, mussels, or mud mixed with shells of any kind, *bona fide* intended for the purpose of manure, to be used within this island, although some of the oysters or oyster brood should be thereby unavoidably taken, removed or disturbed.'

"After the lapse of some years this section was amended, but the objectionable clause was suffered to remain. Thus the matter at present stands, and it strikes me, as a mere layman, that some nice questions of jurisprudence arise out of the position. Such are—in how far can Dominion enactment in regard to the fisheries preclude the local power of legislating on a different specific subject, namely, the promotion of agriculture? And, on the other hand, what right has local legislation to set at nought Dominion legislation by authorizing the disturbance of Dominion fisheries—shell-fish being under the Act?

"It is apparent what an anomalous position the Prince Edward Island oyster fishery is in when the General Fishery Law protects and requires its wardens to protect the oyster beds from fishermen in summer, in order that they may be destroyed, under the

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local law, by the farmers in winter. Such, however, is precisely the case under the conflicting jurisdictions.

"A practical remedy is hard to suggest. The object is, of course, at one and the same time to retain the oyster beds from extinction, and to interfere as little as possible with the valuable privilege of the agriculturist. Perhaps both objects might be attained by repealing the obnoxious section of the local Act, or declaring it superseded, and substituting therefor a regulation setting aside certain spaces as Government reserves to be offered on lease, and further, by encouraging anew applications for grants of shore for oyster culture. Even were this done to a reasonable extent, and were such leases and grants wholly exempted from infringement by diggers, there would still be room enough on dead beds for the requirements of the farmers. Theoretically, the fishery wardens might annually lay off defined localities for the use of the diggers, but practically an employment requiring so much care, time and expense of travelling is beyond the reach of the present staff.

"Any comparison between the relative values of mussel mud and oysters must be, in a manner, fanciful, for the reason that the market price of a load of manure bears but a slender proportion to its results when applied by the hand of skilful labour. Mud is sold, lifted on the ice, at eight cents per load, and, at a low estimate, there must be equal to one thousand farmers who use two hundred loads each per annum. Cash value of 200,000 loads of mud at 8 cents, \$16,000—an amount not directly brought into the island. Quantity of oysters legitimately taken the past year, say 30,000 barrels, of which 20,000 barrels were exported at \$1 per barrel, cost price, \$20,000, which money is brought into the island; to which I must reluctantly add an estimate of 500 barrels illegally taken in the close season for home consumption. Statistics accompanying the next census returns will give the exact number of mudding machines, at which, at present, I only guess.

"The breeding of oysters artificially is now among the established industries of the age. Prince and Queen's Counties, as well as several localities in King's, are especially well adapted to oyster culture. This province, too, has the advantage of having its name known as an oyster-producing country. The famous Bedeque oysters were long a *bonne bouche* loved of epicures. Bedeque is now oysterless. Almost all that is required to partially restore the perishing fishery is a system of inexpensive grants or leases, and protection against disturbance of the beds. The conditions, however, are indispensable, for no scheme of destruction could be devised more certain to obliterate oysters from the list of island products than the digging of innumerable mud holes into which the spawn is washed and, being silted over, perishes. Oyster culturists would, no doubt, attempt to remedy this by the use of intercepting fences of faggots, but such, at best, is a partial expedient.

"As this report will likely be read by persons who may be disposed to try oyster culture on a larger or smaller scale, I give a brief account of the oyster breeding establishment at the Narrows, lot 12, Prince County, the only one in the province, and the property of the Hon. J. C. Pope. The locality is on the mainland of Prince County, and extends from the shore to mid-channel of the narrows, which are here one-quarter to one-half mile in width between the mainland and Lennox Island, the property and home of the remnant of Micmac Indians. The site was leased prior to confederation, under the local Act for the encouragement of oyster culture. The system pursued is to nurse the natural beds and to build new ones where the water and bottom of hard sand and hard mud are suitable. Average rise and fall of tide about two to three feet. Fifteen acres of beds are already planted, and a new one of four acres is being laid down. During the fishing season thirty men with a like number of small boats are employed. Spawn was formerly shipped to England, but is understood not to have paid. An attempt was made to rake the beds by means of a dredge similar to those in use on the British and French coasts, but, from local causes, it was not found to answer, and the oysters are now fished up altogether with 'tongs.'

"One man in a day can fish one, two or three barrels, according to circumstances. The boats, when laden, discharge their cargoes at a receiving house, where the oysters are carefully hand-picked and separated into two marketable qualities, number ones and number twos, the number ones being exceptionally large and fine. The remainder, con-

sisting of dead shells and small live oysters, are laid separately on the new beds in a "culch" or stratum of about six inches in depth, on which the young brood develop rapidly, and in four years from the spawn become of full marketable dimensions. The first quality of number ones are shipped chiefly to Montreal, whence they find their way to the Capital. Number twos are sold elsewhere. None are canned. It is unnecessary to put on record here the quantity annually shipped. The French method of cultivating on *plats* is not practised at this establishment, and might be rather cumbrous where other means answer the purpose, but there is no doubt it would be successful if tried. A piece of telegraph wire was recently fished up completely encrusted with good oysters of uniform size, which indicates that the method by which spat is collected on potsherds strung on wire would answer here. Now that a pottery has been established at Charlottetown, a few thousand *plats* of baked clay would cost but a trifle, and the result would be alike interesting in science and practice. It may be mentioned that the Indians are quiet neighbours, and some of the less indolent are employed in the fishery.

"In spots where it has been possible for the wardens to give strict supervision during the past two seasons, and where the ground was not disturbed by fishers of mussel mud, considerable broods of young oysters have established themselves."

*From annual report, 1881, page 189 : **

"According to orders there have been forwarded to the department, charts of all existing oyster beds in island waters, together with reports on localities in which the planting of new beds would have prospect of success.

"Prince Edward Island is comparatively thickly settled, especially along the estuaries, creeks and coast, where oysters most abound. No restriction has hitherto been placed on their being fished by any resident.

"Neither has any claim been set up to individual rights of proprietorship. Prior to confederation, the local Government assumed the right—if it had it not—to the ownership of all oyster beds, but except in one feeble instance of legislation to regulate the granting of leases, no restriction on general fishing was imposed. The valuable fields of oysters were abandoned as a common, and were by the public so accepted. With the single exception of the field at Squirrel Creek, Prince County, the property of Hon. J. C. Pope, no leases of any account were taken up when offered. This position remains now. The public regard the taking of oysters anywhere, or everywhere, in the light of a common fishery.

"The articles of confederation appear to have settled the ownership of oyster beds not specially covered by land grants as resting with the Dominion Government, but the question of regulating the fishery to its injury, by local enactment does not seem to have yet come up between the general and local Governments.

"When Prince Edward Island joined the confederation of British North America, oyster fishing was signified to remain under existing local laws until regulations should be made, but no special regulations have been made. The local close time, as previously established, from 1st June to 1st September, has since been acted on. In fact, the local laws of the province, even now, regulate the oyster fishery in Prince Edward Island. Those laws permit the digging of shells, 'even although some of the oysters or oyster brood should be thereby unavoidably taken, removed or disturbed.' The popular reading of the Act is that all beds may be dug over, even if all the oysters be destroyed. During the milder days of winter, hundreds of mud-digging machines are at work cutting up the beds. It was expected that, as these machines are an institution almost peculiar to Prince Edward Island, the Island Census returns would have a column in which to show the number in use, but the enumerators took no account of them. There must, however, be not a few hundreds.

"It is, of course, the object of the diggers to strike on dead beds from which can be obtained shells in such a state of decay as to be readily crushed before the plough, when spread on the land, or to disintegrate into pure lime by the action of the winter's frost. Such beds are rarely found. If beds are below the reach of freezing, the surface is covered with a layer of live oysters, while if the centre of a bed has risen to the level of

*Inspector J. Hunter Duvar.

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ice, the sides of the mound, within a surrounding radius, are thickly coated with live bivalves. It will thus be seen that shell digging does, of necessity, presently injure, and must ultimately destroy, the oyster fishery, unless remedial measures be adopted.

"In proposing a remedy, the question is how, if possible, to protect the live shell-fish without preventing the farmers from digging shell manure, a privilege of which they are justly tenacious.

"The possibility of restoring the fishery in any given locality depends on the area of beds and the present and prospective numbers of diggers. Few farmers set their machines for two consecutive seasons in the same place, but wander about over the area looking for a better location. The consequence is, that all the beds are more or less cut up, scarred and seamed with trenches in all directions. Where the area is of some extent, as in bays and larger estuaries, spaces selected with reference to existing beds, currents, depth of water and the locality where dead beds would give the farmers a clear space for digging, might be staked off as Government reserves, which it would be illegal to disturb for a period of, say, three years, which is the term in which the oyster comes to maturity. This is practicable, and in view of the relatively small area that would be reserved, could offer to the farmers no reasonable ground of objection. In creeks and small stretches of water the plan would be less applicable. A three years' reservation of a limited number of sites would allow the fishery officers time to acquire experience in the management of the reserves, and would also feel the pulse of the farmers who, no doubt, would at first be somewhat suspicious of what they may deem an infringement of their rights.

"But the project that would the most speedily place the fishery on a permanent basis would be the throwing open of sites to private lease. Localities leased would be protected by the lessees, under general supervision of the department.

"The local statutes above referred to are 28 Victoria, chapter 13, with an amendment of date 17th April, 1871, wherein it is provided that the Executive has power (individual rights reserved) to grant the exclusive right to fish for oysters or oyster brood and to form new oyster beds or feeding beds in certain rivers specified. (Note.—In Prince Edward Island parlance "river" means an estuary.) The leases to be sold at auction for not less than twenty years, renewable at expiry for a further term of forty years, under engagement that within five years new beds shall be made or old beds cultivated so as to increase the annual yield. In addition to this, the owner of any land fronting on suitable water might obtain a grant of his frontage.

"This offer, proper in all respects excepting the forty years' renewal, which would constitute a monopoly, was but sparingly taken advantage of, and some of the best sites are yet open. The localities first opened to offer were the following, which are still available:—Shemody, Richmond Bay, Dunk River, Prince County; Charlottetown Harbour and certain parts of Hillsborough River, Queen's County. In King's County, Cardigan Bay. In the event of its being decided to plant new beds, any one or all of these localities are suitable for a first experiment.

"While it would be illegal to disturb such beds by digging or otherwise, an additional proviso might be made that no digging be permitted within a distance of a specified number of yards from any planted or leased beds, so that the ooze raised by digging, and held in suspension by the tide, might settle before reaching the live beds. Further, the quantity of seed oysters to be laid down within a given time, say not fewer than one to each square of two to three feet, or about twenty-four to fifty-four barrels per acre should be a feature in the lease. There should also be, as in France, legal dimensions under which no oysters may be taken from the water. It is for Your Honour to consider whether, with a view to revive the perishing oyster supply, it would be advisable (in like manner as section 12, subsection 3 of the Fisheries Act permits to be done in the case of fishways) to assist persons who will undertake, under due bonds, to plant new beds in suitable locations and protect them from being fished for the first three years, and afterwards only in such quantity as the beds will bear. This would give the Government a proprietary interest that would justify reversion at the expiry of the term of grant. If the beds were judiciously cultivated they would be a property yearly becoming more valuable.

"As in most other matters dependent on the peculiar tenure of land in this province, it would be necessary in each individual case to ascertain whether the owner of shore holds a title to the 'land covered by water' to mid-channel. I have reason to believe that in some instances this is the case, and in others not. At all events, the prospective value of the fishery deserves all that can be done for it.

"On bottom less suited for oyster culture, mussels (*Mytilus edulis*) might be grown with little trouble in extensive fields, in sheltered coves, or the brackish water of creeks. The fishermen of Scotland find mussels the best of all bait, besides being used for food. They are found scattered in clumps in the creeks of the island.

*From annual report, 1882, page 173 :**

"In spite of the immense destruction done to the live oyster beds by the digging of shell manure, the wardens report that oysters were never so good or plentiful as this year—the result, evidently, of even the partial protection the fishery officers were able to enforce. What is wanted is complete protection herein by the simple remedy of granting leases. It is possible to enlist private interests in aid of Government supervision, as thus:

"Theoretically the greatest good to the greatest number in this province is subserved by placing no restriction on the taking of shell manure, wherever found, inasmuch as its use is indispensable to the limeless soil of the island, and has increased the product of grass and grain to an extent much exceeding the value of all the oysters taken since the practice of shell manuring came into vogue. But the present value of the oyster fishing is about \$150,000 per annum. The question arises: Is it possible to reconcile these two interests, the farmer's and the oyster fisher's, so that the oyster fishery need not be lost? "The answer is in the affirmative, and the required means are no more than a few simple regulations officially made and definitely carried out.

"We have the example set by the French Government in the restoration of oyster beds. At present no inconsiderable portion of the maritime population of the west coast of France find employment therefrom, and several localities have become the seats of a great oyster industry. The means adopted were very simple, namely, granting portions of the foreshore at easy rents, but under stringent regulations. Private industry did the rest, and the employment is both popular and profitable. Also, much attention is being given to oyster culture in Australia, with good results.

"Under section 12 of the Fisheries Act, the machinery of such development is ready to hand for the waters of Canada. Subsection 4 enacts:

"Special licenses and leases for any term of years may be granted to any party or parties who may wish to plant or form oyster beds in any of the bays, inlets, harbours, creeks or rivers, or between any of the islands on the coast of Canada; and the holder of any such lease or license shall have the exclusive right to oysters produced or found on the beds within the limits of such license, for the term of such lease."

"By subsection 5 the Minister may annually expend an appropriation in restocking beds; and in section 6 it is made penal in any way to injure or disturb oyster beds—which embraces the injury done by mud-digging.

"Having in last and previous annual reports gone fully into the matter (to which I beg to refer), it is unnecessary to occupy space in going over the same ground. Suffice it to say that probably few of the public know anything of the above-quoted subsection 4, and it never occurred to them to apply for an oyster-grant, whereas, were stations previously surveyed and advertised to be sold at auction on a given day, many would have the enterprise to secure one. The department has in its possession a series of maps showing existing oyster beds, also localities in which new beds might be planted or set aside as Government reserves for natural propagation for a period of years—for instance, in Richmond Bay, West and Hillsborough Rivers—or when surveyed into stations to be offered at auction or agreement, to private lessees, suitable localities to begin Bay, Cascumpec Bay. But the grants should be small.

* Inspector J. Hunter Duvar.

"in short, there are many localities in the waters of Prince Edward Island that might be rendered valuable, not only without cost, but with a revenue to the Government.

"It is a thousand plties that immediate measures are not adopted to fully organize this most valuable industry. It is capable of vast development. The demand must always exceed the supply. Oysters are very fecund. The island is as favourably adapted for shell-fish culture as the famed English coast of Kent. Three thousand five hundred barrels of oysters per week during the season were last year shipped from the United States to England. There is no reason that with increased product Prince Edward Island should not ship likewise, and thus tap a large source of wealth."

*From annual report, 1883, page 177 : **

"This province is peculiarly well adapted for the growing of oysters. The waters of half the island were once stocked with natural beds. So lately as 1832 live oysters were so plentiful that legislation had to forbid their being burned for lime. In many places the dead shells of once productive beds remain many feet in thickness. The fishery is but a mere scrap and vestige of what it once was, and might again be made.

"Oyster fishing in the province is free to all, consequently everyone makes the most of it for his own individual benefit, without care for the future. Wherever oysters happen to be a little more numerous than usual, they are immediately fished out. Thus the ground is shifted every year, to the ultimate destruction of the whole area. There is no regulation as to size, hence there is annually destroyed a quantity that I vaguely reckon at not less than 10,000 pecks, equal to 1,000,000 of shell-fish that, under due restrictions, would come to maturity. It is not too much to say that as many oysters as one-fourth of the whole consumption and export are destroyed every year by the digging of shell manure. Although even under the present careless system a sufficiency can be got to export annually 30,000 to 40,000 barrels, the best beds are being slowly but surely exterminated.

"This is an evil that is quite remediable, and by simple means. The present Fisheries Act provides the machinery. The history of oyster culture and oyster fishing in the Netherlands affords valuable hints as to details.

"The object to be aimed at is two-fold, namely, to make the most, permanently, of the present supply, and to increase that supply. To do this, requires oyster culture to be carried on along with oyster fishing.

"Natural oyster beds owe their location to accident. They are scattered patches, larger or smaller, that owe their change of locality to tides, winds or other not controllable causes. Accordingly, we find stretches of bottom quite suitable for the growth of oysters, but on which none have grown. Every spring the fishermen take soundings for the scattered beds, and when such are found, they are worked till completely cleared. It is evident that under this pernicious system, total extinction is merely a question of time.

"There are two distinct oyster fisheries requiring to be differently dealt with in this province, namely, in creeks and tidal rivers, such as Mill, West, Tryon, Enmore, Hillsborough, Johnston's Rivers, the Narrows, &c., and considerable bodies of water, such as Richmond Bay. In addition to these are localities where the fishing has been quite extinguished, but where it might be revived, as Bedeque, Winter River, and elsewhere. And finally, there is unlimited room and suitable ground for planting of new beds in many parts of Queen's and almost all the creeks and bays of King's County, where oyster beds have not yet been grown.

"To the question of how is this to be accomplished, the answer is brief: By Government regulation of private culture under section 15, subsection 4 of the Fisheries Act, and by Government aid in establishing experimental culture under section 15, subsection 5 of the same Act.

"Several applications for license to cultivate oysters have already been forwarded to the department. I have recommended that all these be granted, subject to the conditions

*Inspector J. Hunter Duvar.

which seem necessary for the protection of the Government, and of the public. The conditions are, that the area leased be of moderate extent, that in the first instance, the term of lease do not exceed nine years, as provided in section 2 of the Fisheries Act; that during such first term the annual rent be low, or nominal, but renewable for a further term at an enhanced rental on valuation; that within a given time a certain defined proportion of the area be planted with brood oysters, at the rate of (so many, according to each case) to the yard square; that after the lapse of three years from the date of grant not less than (a specified quantity), nor so many as would deteriorate the bed—in which, of course, the Government would retain reversionary interest—be annually fished; and that at all times said oyster farms be under the supervision of the fishery officers. On these conditions, it is believed that many leases would be taken up in creeks and estuaries, were advertisement made that the waters were thrown open to lease. A right of priority of claim, before a specified date, might be given to persons owning shore frontages. Excepting in so far as rivers may be defined under section 7, subsection 7 of the Act, I am not competent to express an opinion as to riparian claims set up on the banks of tidal water.

"In the greater waters such as Richmond Bay, the system might require to be modified. Here, the applications would mostly be for sites, on which workable beds are already existing. From difficulty of defining small patches of space in the bay, the area would have to be larger. Twelve acres have been found a practical size in the Zuyderzee, Holland, which, in its features, bears some resemblance to Richmond Bay. One hundred and fifty acres is the largest single area granted by the Dutch Government. A rapid increase of production has taken place in Zuyderzee, since the leased beds were withdrawn from public fishery, and there seems no reason why similar satisfactory results should not follow under like circumstances in Richmond Bay. As the bay is large, about six by ten miles, it would not likely be all applied for, and the present practice of free fishing need not be interfered with on the unleased portions. Indeed, it might be advisable to begin by offering only a limited number of leases until the success of the new system be proved, and the public mind be educated to accept it. One thing is certain—the present system is eminently wasteful and unsatisfactory. In this connection, a report, from Warden V. S. Gillis, of Indian River, an inlet of the bay, says: 'There have been engaged this season, regularly oyster fishing on Richmond and Malpeque, about 150 boats and 300 men, allowing two men to each boat. Each boat averaged about six barrels per day. The oysters are without any doubt a great source of wealth, and should be carefully protected. I have been speaking to several fishermen (French), and they tell me that they cleared in cash \$140 per man, since 1st September to 17th November. They also say that the oysters are as plentiful and as large as they have been for the past three or four years. I have been asking them as to the size and length that should not be fished. They say that oysters less than two and one half or three inches, should not be caught, because when re-pecked, these small ones are thrown away, whereas if left on the oyster bed, will, on some future day, be fit for market. I think the leasing of the oyster beds will be the means of causing a great deal of litigation between parties concerned. I think a very good way to protect the oysters would be to allow no fishing in the spring of the year, and to extend the close season till the 15th September instead of the 1st of that month as now. It will benefit the fishermen because, as it is now, they generally take up a great number of oysters during the first part of September, too many for the demand, and the consequence is that quite a lot of them get spoiled, and it keeps the price low for the rest of the season.'

"With regard to Government aid in the formation of new oyster beds under section 15, subsection 5, of the Fishery Act, although very desirable, it need not be on a large scale. The experiment would be in the light of a model farm for the instruction and initiation of the public. Two suitable localities offer, the first being the estuary of Winter reserved River, where in former times there was a great supply, and where the bottom is now paved some feet thick with dead shells. The other locality is the estuary of Cardigan River, in King's County, where the bottom is clean and suitable, no manure being dug, and no steamboat on the river. As there are at present no oysters in King's County, the planting of a bed or beds would be viewed with interest, and could net fall greatly to

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benefit the county. I estimate that an experimental bed, planted with 150 barrels of brood oysters, could be made at either of the above localities, on buoyed ground, properly levelled and harrowed, for the sum of \$300, or less, exclusive of railway transport. A small grant of \$600 would thus establish self-paying models in two different parts of the province, where oysters are not now found, and from the product of which other plantings could be made. For the first three years, until the beds become remunerative, no staff would be needed beyond the present fishery wardens. So much of the foreshore is suitable for shell-fish culture that the trouble and cost of laying off need be comparatively small. Survey of private areas would be at the expense of the applicants.

"The great drawback on the oyster-fishery of this province is the digging of oyster shells for manure, under the name of 'mussel mud.' This is a subject that will have to be faced sooner or later, and the sooner the easier. The digging of shells for calcareous manure is an important part of the industry of farmers residing not only on the shores of creeks, but within several miles of the water. It is impossible to state accurately the number of power digging machines in use every winter, but there must be many hundreds. No restriction whatever being placed on digging, the live beds are cut up at random in all directions. Oysters are protected by the fishery officers in summer, that they may be destroyed by the farmers in winter.

"The marking off a certain number of spaces in the principal oyster waters as Government reserves or leases would be the first step towards a better state of things. In this I perceive neither difficulty nor injustice. The farmers would be deprived only of the very limited spaces required for artificial culture, and might, as heretofore, continue to have free access to areas amply large enough to supply them with manure. These general views express the possibilities. Details shall be laid before the department when required.

"The oyster fishery of Prince Edward Island is of importance, greater than that of any of the other Canadian provinces. It brings, in cash, say \$80,000 to \$100,000 per annum, by way of export, over and above supplying local consumption. In the course of a few years it might be increased many fold and yet the privileges of the farmers remain intact.

"Prince Edward Island oysters have long maintained a good fame. The name of 'Bedque Oyster' is still used as a term of excellence, although oysters are not now fished at Bedque. Shipments are made to the markets of St. John, Halifax, Quebec, Montreal, Toronto, Ottawa, and other cities. Two forms are found indiscriminately on the beds, namely, circular and long. It may be curious to ascertain scientifically whether these are two distinct species, the *Ostrea canadensis* and the *O. borealis*, or merely difference of form. At all events, the variation is established in their earliest growth, for the same stone, or old shell, has frequently adhering to it, young oysters of less than an inch in length with the two forms definitely developed. Both varieties are equally valued as food. Private culture would speedily prove whether the different forms could be grown separately, and which kind would be most in demand.

"It has been difficult in past years to distinguish accurately the quantities actually taken in the respective localities, inasmuch as they passed through various hands before reaching the point of shipment, and hence were apt to appear twice in the returns. In view of possible reorganization of the oyster fishery, the greatest care has been exercised in checking the exact product this year, namely, as nearly as possible, 35,000 barrels, which, at the official rate of \$3 per barrel, represents an article of traffic close on \$100,000 value."

*From annual report, 1884, page 243 : **

"The knowledge gained by certain observations elsewhere referred to, should be of great value in laying down oyster beds, for artificial culture, in localities of the island waters wherein natural beds are not found. Our whole shore is fringed with creeks and estuaries, wherein oyster farming might be successfully and profitably carried on. The requirements of shelter, absence of excessive tide, suitable bottom, and the proper degree of salinity are everywhere.

*Inspector J. Hunter Duvar.

"There are a few facts with reference to existing natural beds that are to be taken into account. Many parts of the bottom of creeks and estuaries are of hard 'mud' (so-called), formed by the disintegration of sandstone mixed with washings of underlying clay, until of the consistence of brick paste, with but little vegetation. No better bottom could be found for the laying down of brood. In other places are deposits of shells, where ~~systems~~ once were, but are not now, which is also good bottom for planting. The main requisite for good bottom is that it shall give a foot-hold for ready attachment, and be so firm that when the oyster opens its shell the washings or impurities may flow into the animal. Hence the use of tiles in oyster culture in Europe. Broken shells and projections of clay offer, in this island, the same conditions as the artificial trays and made floors of Europe. On these ready points and projections the 'spat' or spawn, emitted from the brood oysters, catches and adheres. I do not think the spat has sufficient vitality to drift long distances. The minute young must be most delicate, much more so than the young of swimming fish. A favourite resting place of the spat is on the edge of the laminae of old shells. There once established, the young oysters grow in clusters, to the dimensions, say, of 2 inches in length the first year. Thereafter the growth is proportionately more rapid, until at four years they are fit for market. It is a noticeable fact that all the oysters in a cluster do not grow on the same plane, with the inferior (flat) shell downwards and horizontally, but grow perpendicularly, or at all lesser angles, the arrangement evidently being that each individual oyster shall grow with reference to the others, so as to have the largest facility for opening its shell. In this circumstance is a key to the destruction, from natural causes, of self-planted oyster beds. Thus, when the oysters in a cluster come to maturity, and in due course of time themselves emit spawn, such spawn or spat is caught on the ragged points and edges of the parent shell, forming a second growth above and upon the first. The process of stratum growing on stratum, floor upon floor, goes on increasing the bed in height each year, while, at the same time, the base is being extended, until the mass becomes a mound of oysters, sometimes of large area. The inner strata of this mass, being, from the superincumbent pressure, unable to open their shells, perish from suffocation, so that the mound comes to consist of a core of dead shells, with a thin covering of live oysters on the top. Where the mound, by annual increase, grows so high as to reach the ice-line, even that thin covering of oysters is killed. Moreover, these oyster banks in the channels collect ooze, mussels and rubbish, tending still further to destroy the bed, until sooner or later it perishes. This destruction would be prevented by artificial culture in removing obstructions, raking the beds, preventing too thick a growth, and shifting the growing oysters into new water two or three times before they come to market. By such culture all waste is avoided and a much superior article produced.

"These natural causes sufficiently account for the rapid deterioration of our oyster beds without the added destruction of digging them up for farm manure. Notwithstanding these depressing agencies, 28,320 barrels were this year sent to market, mostly in Canada. It will be observed that all our oysters are what are known in Europe as 'sea oysters,' that is to say, oysters that are taken from natural beds *in situ* and which, as their shells are rough and unshapely, fetch a much less price than the oysters of cultivation, the shells of which are thinner, smoother and more symmetrical. Two forms of oysters are found growing indiscriminately on the Prince Edward Island beds, namely, the long Canadian oyster and, in a lesser proportion, oysters circular in form. I am not naturalist enough to decide whether these are different varieties or merely variations in form.

"The time seems to have come to open the oyster grounds—or a part of them—to lease, under due regulation. As matters at present stand, no one will venture the risk of artificial cultivation. The present state of the law and the custom of the country are exceedingly indefinite. Unsatisfactory. It is doubtful if the law would protect private oyster beds from being leased under the guise of shell-digging. Hence the necessity for the area of artificial culture being secured by lease or grant, or by being set aside for the public interest. In last year's report I submitted details that, I think, would meet the case, and to which I beg to refer.

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"The fishery has not been so steadily pursued this year, owing to continued bad weather, which readily agitates the shallow water in which oysters are found. A number of oyster fishers have removed from Percival Bay, which has generally given a good yield. Two hundred boats were regularly employed oyster fishing on Richmond Bay. Twenty-four barrels are reported from St. Peter's, a new locality."

*From annual report, 1885, page 257 : **

"In previous reports I have solicited the consideration of the department to the unsatisfactory condition of the oyster fishing in this province. The experience of the present year shows an increase of the evils complained of. More men are engaged in fishing, and as the demand is at least equal to the supply, increased exertions have been put forth. Small beds hitherto neglected have been sought out and fished bare. Persons not connected with fishing have gone into the speculation of shipping, and it may be said the industry this year has reached its utmost limit. Over-production threatens the oyster fishery, and with the same result as in lobster canning.

"Following the lead of parties in New Brunswick, who are said to have shipped large quantities from Bay du Vin, and elsewhere, a movement has been made in the shipment of oysters in the shell to London, England, by steamers. If this enterprise be successful it will be attended with weighty consequences to the island fishery. The oysters are put up in boxes containing about one-third of a barrel for retail. The movement has been inaugurated by persons in the dry goods trade, but if it prove a commercial success, it will be followed by a host of imitators, all drawing their supplies, without restriction, from the best beds they can find. The present would seem a favourable opportunity to regulate the size and quality of oysters that may be legally exported before the speculation becomes too large to admit of such. A demand for the English market would let loose still more fishers at random on the beds and still more rapidly fish them out. According to recent advertisements, London fishmongers offer to sell packages of oysters, carriage free, at prices varying from 18s. per 100 for Whitstable to 6s. 6d. per 100 for Anglo-Portugo. Supplies from Prince Edward Island would probably rank with Portuguese, or a little higher, but even at such price would leave a margin for profit, and it would be well to regulate the catch now in view of a probable English traffic.

"As was not unnatural, extension of the close season did not meet with the approval of fishermen whose interest it was to have as long a season as possible in which to dig and sell to the shippers. They looked at it merely in the light of fourteen days knocked off their earnings. A newspaper even spoke of it as 'an encroachment on fishermen's rights.' Such a view may at once be set aside. The 'rights' of fishermen are the right to make legitimate use of fishing facilities without undue interference with the rights of others, whether those others be of the present time or coming afterwards. What limitation the exercise of such right may call for to render any fishery permanent for the benefit of the future, as well as of the present, is within the duty and discretion of the Government. Canadians of the future, as well as of the present, have the 'right' that the fisheries should be preserved from the avarice of the moment.

"I gather that the intelligent public in general regard the shortening of the fishing season favourably, and many believe that a still longer extension of close time would be judicious.

"There are not wanting persons in the trade who maintain that the industry requires no regulation, and that any interference with it would be tyrannical. Communications have been sent to the press that the beds, merely by being stirred in fishing, are benefited and extends their area, by its answering the same purpose as the 'raking' of artificial culture. This statement, on which the advocates of the present state of things lay so much stress—that the beds prosper all the better for raking (*i.e.*, fishing)—is one of those half-truths that deceive more readily than absolute falsehood. The raking the beds receive in indiscriminate fishing is not of the right kind. Every one who has watched oyster-tonging must have observed that the process is a mere stirring up of the mud, and not raking at all in the true sense of separating the clustering oysters and giving

* Inspector J. Hunter Duvar.

them room to breathe. So far from assisting to provide a supply of clean shells to which oyster spat may cling, the settlement of the stirred-up soil covers the full-grown shell with a deposit of slime, on which it is impossible for the almost microscopic spawn to take hold and live. The 'raking' of beds periodically is a process of considerable skill in artificial culture, and is impossible on beds free to be fished by all comers.

" Several suggestions have been made to me respecting the nomination of oyster inspectors to see that all undersized oysters are returned to the water, and the newspapers announced, prematurely, that I had applied to the Minister for the appointment of such officers. This is a matter that requires consideration. While it is beyond question that all oysters under given dimensions should be returned to the water it is extremely doubtful if the appointment of special officers, charged to see to that duty, would be effective in having it carried out. In the first place, it would take at least half a dozen inspectors to oversee Richmond Bay alone, where 300 boats fish and land their catch at different points. That part of the bay on which natural oyster beds are found extends over an area of about six to seven miles from east to west and four miles from north to south. Grand River, the Narrows, Lot Eleven, Cascumpec, Pownall Bay, Orwell, West River and other localities where oysters are fished, would demand similar officers. Such officers must either be attached to the general fishery staff under the general inspector of fisheries or be distinct from it, and in either case they would come in contact with the duties of the regular fishery wardens. The expense would be more than the proportionate value of the fishery would bear, inasmuch as wages, better than could be elsewhere obtained, would be required to secure the whole time and services of suitable men, whose duty would require them to be about all the time, from early daylight till late at night in order to do any good. At present there is no order defining the size of shell under which oysters are illegal. Having given the subject due consideration, I am inclined to think that a stringent regulation, bringing the matter within the jurisdiction of the ordinary fishery wardens by defining the dimensions of oysters under which size possession shall be illegal, and the appointment of two additional wardens for Richmond Bay, provided with suitable boats (which could be provided, all found, for not exceeding \$37 each) would, for the time being, answer the purpose and be as much as the present state of the industry would justify. As the oysters are landed at many points along the bay a boat for each of the two wardens is indispensable, as it would be impracticable to visit all the landing places on foot. Were such official boat seen afloat it would soon educate the fishermen into what is required of them. At the same time, I would urgently point out that the proposed wardens should be persons living on the shore within sight of their work, the one on the south side, at or near Shemody, and the other at or near Oyster Cove, on the north side, these being the two chief points from which poachers issue to fish oysters during the close season. Unless the wardens have at all times the expanse of the bay before them, visible from their own doors, so as to see at once, and follow, boats out in the close time, I should consider the salaries paid them as thrown away. Such wardens might make it a special point of their duty to see that oysters are not fished illegally in the close season and hidden in *caches* in the bay to rush for shipment on the first day of opening. This year fishing began on Tuesday midnight; on Wednesday 600 barrels were on the market—an impossibility by legitimate fishing. But I would express a very decided opinion that the appointment of special inspectors, charged solely with the business of seeing that small oysters are not landed, would, in working, be found cumbersome, ineffective and largely expensive.

" It has been brought to my notice that shipments to Montreal and elsewhere frequently arrive in inferior or bad condition, especially in the early part of the season, and it has been asked whether the fishery officers cannot interfere to prevent such shipments. To my mind this is quite beyond their purview. Fish in the sea, or in process of being taken, are fish under the regulations of the Fisheries Act. When legitimately landed and ashore they become "goods" subject to the usual chances of commerce.

" On the subject of our Island oyster beds, a St. John, N.B., paper has the following pertinent remarks:—'The chief source of St. John's oyster supply is the oyster beds of Prince Edward Island. Formerly many of the oysters used in St. John came from Shediac and other points along the north shore. Latterly these beds, which were all natural formations, have been exhausted by continual and indiscriminate raking, leaving

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only those of Prince Edward Island from which to draw the local supply. If some kind of protection is not applied soon these, too, will share the fate of Shediac, Buctouche and other exhausted localities, and oyster fishing in the maritime provinces will be a thing of the past.'

"Notwithstanding the truth of the above observations, it is not meant to be implied that the Prince Edward Island beds are already fished out, for two to four barrels of oysters per man still reward the fishers on Richmond Bay, and the total catch (for home and shipments) of perhaps 40,000 barrels is a contribution of some magnitude to the resources of this small province. But the very fact that good wages can yet be made, and the active speculation that has set in, and will certainly yet further set in, renders the rapid impoverishment of the beds the more certain. For no uninterested person, conversant with the market, will deny that while the fishery is only kept up to the mark by extra force, the demand is increasing instead of falling off. The result must necessarily be overstimulation. New adventurers are, and will be, attracted into the field, regardless of the future of the fishery so that present ends be served. The question for consideration is therefore two-fold; firstly, how to husband the existing supply, and secondly, how to provide a future supply.

"With reference to the first of these, things can be done in Europe that could not be attempted in free Canada. Nor is it desirable they should. The French coast-prefects are said to assign the tale of oysters that may be taken by each boat, and the same is done by some of the English oyster guilds. This being here impracticable, there only remains to husband the supply by shortening the fishing season.

"Although oysters may legally be fished in Canada for eight months and a half of the year, nature practically limits the fishing time to three months and a half. This embraces two distinct periods, namely, spring, up to 1st June, four to six weeks, or thirty-six working days, and fall, after 15th September, about eleven weeks, or sixty-six working days, the latter being the main working season. An expert has given an estimate, that in the fall fishery Richmond Bay alone produces a thousand barrels each clear working day, but this I regard as considerably over the mark. Were it decided to shorten the time of fishing, it must come off one or other of these two periods, the spring or fall fishery.

"Against wholly prohibiting spring fishing, it is urged that customers look with avidity for the first supplies, that oysters cannot be kept over winter to meet the spring demand, and that it would deprive farmers along the bay of a source of income that is now available, before they settle down to farm work. *Per contra* it is stated that abolishing spring fishing would affect fewer persons injuriously than shortening the time in fall would. According to the limited amount of information at present known, the question of spawning does not enter into consideration. It is merely a question of supply. The matter is remitted for consideration of the department. It is safe to prophesy that whatever course may be adopted, any change in present arrangements (or rather absence of arrangement), will meet with opposition from fishers engaged in the actual work of catching, and most likely from some of the speculative shippers. The very quantity taken this year, in fourteen days shorter time, is certainly not an argument in favour of a lengthened fishing time. On the contrary, it indicates that in a shortened season enough can be taken for the good of the beds.

"Summerside being by far the largest port of shipment, it may be taken as a criterion of the trade. From the following table of shipments thence, it will be seen that the export in the first month and last month of the season was comparatively trifling, so much so that both these months might be struck off the legal fishing without any marked effect on the general business. Families, however, lay in their supplies as late as possible for winter, so that the latter half of November could not conveniently be dispensed with.

	Barrels.
" Spring fishing—Oysters shipped from Summerside from opening of navigation to 1st June.....	764
" Fall fishing—1st to 30th September.....	5,449
1st to 31st October.....	6,968
1st to 30th November.....	4,800
1st December and later.....	104

"May and December stricken off would, therefore, but slightly affect the aggregate supply—at present.

"As regards the extension of supply under private care and by artificial culture, I can only repeat what is set forth in Prince Edward Island annual fisheries reports for 1884 and previously, and to which I beg respectfully to refer. The points therein indicated are :

"1. The laying off and offering at auction or otherwise the lease of defined areas of oyster bottom of moderate extent, at a small upset price for a short term of years, subject to the condition of planting and afterwards of fishing, subject to regulation, leases being renewable for a further term at valuation, Government retaining a reversionary interest in the same. Several applications for lease are already on file with the department.

"2. The placing in the estimates a moderate sum, under section 15, subsection 5, of the Act, say \$1,000, to aid in the planting of beds in new localities.

"3. To which was added, supplementary, the establishment of one or more Government oyster stations or farms, which should be self-supporting, as a source from which young oysters for planting might be drawn. This suggestion, however, is not of immediate necessity, and, with Nos. 1 and 2 (as above) in operation, might not be needed.

"Unlike some other enterprises, the time required to test, or rather to prove, the success of oyster culture, is very short. The large quantity of undersized oysters, now wasted and a nuisance, would become a marketable commodity and be utilized in planting new beds. In four years, oysters grown from such seed might be placed on the market of (second) merchantable size. In five or six years they would be full grown and have reproduced. On the other hand, there is every appearance, that in three or four years more of the present unregulated fishing, the estuaries will have been swept bare, and evil effects be felt even over the extensive area of Richmond Bay. In all the oyster fisheries on the coast of the United States the beds are carefully protected. Here every fisherman fishes wherever he has a mind, until he demolishes the beds, and the areas are torn up every winter by mud machines. This is a state of things that is surely not beyond remedy.

"Popular objections are occasionally brought forward questioning the power of the Government to lease the Prince Edward Island oyster grounds. The circumstances of the oyster fishery in this province are these : 1. Oysters are taken only in tidal salt-water, navigable for boats and small vessels, say two to eight fathoms, and such tidal water is not included in land grants. 2. The local Government exercised the power of leasing oyster beds and areas (making no mention of riparian or littoral claims, hence it may be assumed there were none); but by enactment, manure diggers may dig on all areas, 'even although some of the oysters or oyster brood should be thereby unavoidably taken, removed or disturbed.' The popular reading of the clause is, that all the beds may be dug over, even if it destroys all the oysters.

"WHAT IS WANTED.

"Stringent regulations to prevent the oyster fishery from being destroyed by promiscuous overfishing.

*From annual report, 1888, page 181 : **

"Last year the number of boats engaged in oyster fishing in Richmond Bay alone was estimated at 300; this year, 500. Persons flock from all parts of the country to this fishery, the work, besides requiring no outfit, being comparatively easy, and, at least for part of the season, paying well. It is no uncommon day's work to average two or three barrels per man. The fishery opened at daylight on 16th September, and on 17th nearly 800 barrels from Richmond Bay were delivered to the dealers in Summerside. The first day's shipment by steamer included 440 barrels to Quebec and 236 to Montreal, some eighty barrels of which were sent by express to Quebec, thereby anticipating the market by twenty-four hours. During the season some orders were filled from Chicago and Mil-

* Inspector J. Hunter Duvar.

waukee, thus opening up a market that is new. As elsewhere stated, the catch of this year exceeds that of last by nearly 5,000 barrels.

"It is common to hear the assertion that the beds are not falling off, but that they increase in production the more they are raked, there is no doubt the fishery is carried on in a wasteful manner, especially by the destruction of small oysters. It is true, that in the past year more of the bivalves have been taken, but it must be remembered that many more fishermen were after them. The preservation of young oysters not yet old enough to spawn forms an important subject of attention in the oyster culture of both continents. The destruction of these year-old shells is a heedlessness—call it a crime—for which there is no necessity, and from which no benefit of any kind is derived. They are not marketable in any way. The remedy, too, is simple. Cause the oysters to be culled in the boats, and make possession of small oysters on land—say two and a half inches or less in greatest length—punishable by fine, whether in the hands of fishermen or on the premises of dealers. An Order in Council would effect this, and it is perhaps the only new regulation at present called for as regards the Prince Edward Island public oyster fishery, excepting that it is a matter worthy of consideration whether every boat engaged in the oyster fishing should not be required to take out an annual license for that purpose. Individual offenders against the law are not easily identified, and it would much strengthen the hands of the fishery officers could the boat license be called for. The license need not be oppressive—say, one dollar—and, to save trouble to the department, might be issued by the inspector. It is a matter of registration, not of revenue.

"With reference to the protection of the beds during the summer months, it is certain that so long as the public persist in eating oysters in the close season, so long will the restaurants continue to supply them. With some degree of caution supplies may be bought from poachers all summer, and the oysters be safely dumped after nightfall into cellars, from which it requires a regular information and a search warrant to extract them. Hitherto, the protective force has not been strong enough to grapple with this abuse, but the recent appointment of wardens at West River and Pownal Bay, in Queen's County, and Richmond Bay, in Prince, should go far to check the illegal sources of restaurant supply. The special duty of the new warden (Ramsay) on south side of Richmond Bay is to be afloat during the close season with sufficient witness to identify offenders. One more warden with like duties afloat on the north side of the bay, and with residence at 'the old store,' is required to complete the water patrol, and I would urge that such warden be appointed on the same terms as Warden Ramsay.

"From the deposits of shells on dead oyster ledges in many parts of the province, it is evident that extensive stores of oysters were found in localities where none are now. These could easily be revived at little expense. The main fishery is in Prince County; Queen's County still has valuable beds; King's County has none, yet King's seems entitled to share in so valuable a resource. I would, therefore, venture respectfully to recommend that a sum of, say, \$1,000 be placed in the estimates for the planting of oyster beds in King's County, and in such other localities as the amount of appropriation might cover, under section 15, subsection 5, of the Fisheries Act. Such planted beds would be Government property for the supply of stock for private artificial culture, and in the course of not more than three or four years should become self-supporting, which brings me to the subject of private culture, under section 15, subsection 4 of the Act.

"The area of ground in the 'creeks' and sheltered bays of this island eminently adapted for oyster culture is very large. In some instances suitable ground is covered by land titles, and I have reason to believe that were areas protected for oyster breeding, many sites would be taken up. It is unnecessary in this report to go into details of regulation or management, but I am prepared to furnish a practical and inexpensive scheme, should such be required by the department. Here, likewise (as in the case of licensing oyster boats), it would not, for the first three or four years, be a question of revenue, for the reason that even the best practices of the oyster culture of Europe and of the middle United States would have to be modified by experiment to suit the Canadian climate. Meantime, so much oyster ground lying idle is a waste of national resource. Indeed, an oyster fishery well developed is of much higher importance than a mere supply of bivalves. The oyster industry of the State of New York, for instance, gives employment to 50,000 men."

*From annual report, 1887, page 173 : **

"The only regulation in this province is a close season from 1st June to 15th September, inclusive, thus not preventing winter fishing through the ice, by which vast quantities of young oysters are frozen and perish. Nothing prevents the fishing and loading of unmarketable oysters two or three inches in length. Vast quantities of these, the future brood, are brought up by the fishing tongs, and go to swell the nuisance heaps in the yards of packers. Such reckless waste by fishermen should be punished by fine. I have reason to know that the principal shippers are agreed that a restriction should be put on such waste. A fishery warden with a boat was placed on Richmond Bay last year with good effect during the close season. Another warden, also with a boat, is urgently needed on the other side of the bay to co-operate with Warden Ramsay. The Richmond Bay, the principal seat of the fishery, paved with oyster beds, is six or seven miles in length and cannot be effectually watched by one warden.

"Oyster fishing in Prince Edward Island is of two kinds, bay fishing and fishing in creeks and estuaries. These require to be differently dealt with, but in both the principle is the same, namely, to protect the young and to see that the close season is strictly observed.

"In view of the report of the commissioners on shell-fisheries, it would be out of place here to discuss the abstract question of oyster fishing. The points that are at present glaringly wanted are to define the limits of beds reserved for the public, to specify under what regulations they shall be fished, to prevent the destruction of small oysters, to prohibit winter fishing, and to open a liberal system of encouragement to private oyster culture. All of which amendments may be hoped for in the future."

*From annual report, 1888, page 127 : **

"Oyster fishing was prosecuted with vigour. According to a proverb among fishermen that a dry summer produces good oysters, the quality has been superior. The market runs in commercial grooves, the shippers supplying the same customers year after year, chiefly in the upper provinces; but were increase of production to take place, new markets would open, the oyster being one of the few articles whereof the supply rarely equals the demand. In 1886 were produced 33,125 barrels; in 1887, say 38,448 barrels, and this year 35,861 barrels. To this add 2,000 barrels used in home consumption. The catch would have been larger but for unsettled weather.

"In accordance with directions from the department, extra care was this year taken to prevent the shipment of oysters in advance of the legal day. Efforts were successful in checking it, but, as usual, an immense rush was made in the earliest days of the season. The first shipment, 440 barrels, was made from Summerside on 18th September, and 1,000 barrels more before the week was out. One consignment of ten barrels was expressed to Quebec on the first legal day to head the market, at an expense of \$25 freightage.

"Canada is perhaps the only civilized country in which the oyster fishery, as a national resource, is not carefully developed. The State of New York has just completed a 3-years' survey of its oyster beds, under the able superintendence of Mr. Eugene G. Blackford. Connecticut has made an exhaustive survey and issued easy and practical regulations for private culture. Delaware, Virginia, and other States, have comprehensive rules. What has been done in France, the Netherlands, Britain, and, in a lesser degree, in Germany, need not be here mentioned. Suffice it to say that in all the countries named, the Government can lay its hand on any spot of ground suitable for oyster culture, and the public are encouraged to develop the oyster industry both by public and private culture. In Canada it is not so. In Australia oyster planting is being attended to. An English company, crowded for room at home, has even leased the Bay of Aboukir, in Egypt, for a like purpose.

Canada possesses oyster waters quite as extensive as the State of New York. Those New York waters give 7,000 oystermen a permanent living, and a capital of \$6,000,000 is invested in culture therein. In the whole of Canada no one man makes his whole

*Inspector J. Hunter Duvar.

living from oysters, but less than 1,000 men give themselves occasional employment in oyster catching, in a perfunctory kind of way, and the total annual product, at \$3 per barrel, is no more than \$187,580, of which Prince Edward Island provides \$109,324.

"The points designated as the duty of Mr. Blackford, the New York superintendent of oyster culture, were, first, to survey the oyster territory of the State; second, to designate and set apart the natural beds of oysters; third, to ascertain the owners and condition of all artificially planted beds; and fourth, to survey and definitely locate artificial beds. These are the identical points that Canada, sooner or later, will have to attend to. I venture to offer these suggestions for the reason that Prince Edward Island contributes considerably more than one-half of the entire Canadian catch, and hence has an interest in the development of our oyster resources larger than any other province.

"That the oyster fishing in Prince Edward Island is in a deplorable state—overfished in places, and in other places not producing enough—there is no doubt. There are no regulations whatsoever, excepting a close season from 1st June to 15th September, to prevent the ultimate ruin of the beds, as they are open to be fished by everybody, and private culture has not been encouraged. Reckless fishing and continued shell digging threaten a ruin to the oyster fishery similar to that which, from overfishing, has befallen the lobster industry. With the present demand, new adventurers from distant parts of the province and even from the mainland, are crowding to the beds and carrying off large quantities, not included in official returns. For instance, fifteen schooners from Nova Scotia, bringing their own men, made descents on Orwell Bay this year and last, leaving the beds nearly exhausted. Finding it pay, others will flock in, regardless of the future of the fishery. It is time such profligate misuse of public resources should be checked.

"Scientists believe that, quite apart from overfishing the oyster beds in the Gulf of St. Lawrence are perishing from natural causes, chiefly geological, and that, as these causes continue, the mollusca in the Gulf will become extinct. In this view I agree. It accounts for the vast deposits of oyster shells, sometimes many feet in depth, found today where no live oysters are. The process of dying out is very slow, but none the less sure. No more forcible argument could be found in favour of artificial planting and culture. Every natural oyster bed perishes, after a lapse of time, from the necessities of its own growth, its increases in height and diameter, the oysters in the interior of the mass are deprived of air, and are smothered. When the bed reaches the ice level, the top perishes from cold, so that, practically, a natural bed of even moderate size, is merely a core of dead shells with a thin layer of live oysters outside. The reproduction of an oyster bed is by throwing off glutinous spat in an ever increasing radius, but it is apparent that unless the ground around such bed is clean and of sufficient consistency, the spat perishes and the bed becomes extinct. Such conditions of oyster life cannot exist where the ground is cut up by trenches and filled with the slime of mud digging.

"Nevertheless, the machinery for a complete organization of this most important fishery is ready to the hand of the department. All that is wanted is: 1. To reserve certain natural beds for fishing by the public; 2. To offer liberal encouragement for full development of the fishery under private culture; 3. It might not be necessary, but power is provided for Government to plant new beds and replant old ones; all which machinery to be operated, of course, under competent supervision. Several applications have already been made for leases for culture, which are on file in the department.

"Natural oyster beds owe their location to the chances of accident, especially of tides. Spat is carried to a distance and there deposited. Consequently large stretches of suitable bottom may be passed over by the mere turns of chance. It is these suitable blank locations that private culture is intended to utilize.

"The breeding of oysters artificially is one of the recognized industries of the age. Astonishing results have been attained in the hands of private culturists. The capital required is comparatively small, the time of expectancy is short, and the crop in three or four years is as sure as anything can be that depends on the elements. I do not see any necessity for jealousy between the fishers of public beds and private planters. Such has not arisen in other countries, and there is in reality little room for a collision of interests.

"The revival of the oyster fishery does not offer the same difficulties that are met

with in other fisheries. It resembles more an agricultural process ; the seed is sown on a prepared soil, the crop is attended to and cultivated when growing, and in four years the harvest is reaped. The oyster plant is perennial, and lives to a great age. I have before me an oyster shell from Curtain Island, Hillsborough Bay, ten inches in length, and showing over forty annual layers of shell. Once established by artificial culture, the supply might be made practically inexhaustible, inasmuch as oyster enemies, especially starfish, are comparatively few in these waters. Oysters in Prince Edward Island are taken only in shallow bays or in the tidal creeks from one to six fathoms, and such tidal water is not included in land grants, and hence under the jurisdiction of the Crown. In the present unsettled state of the fishery no one will risk the planting of private beds, as it is doubtful if either the law or custom of the country would protect them.

"The leasing of areas for private culture would be a check, however imperfect, to the extinction of natural beds from natural causes, for the reason that they would throw off their surplus of free floating spawn and thereby make the natural beds more likely to be impregnated. The first part of lessees' enterprise in artificial culture would be to level the ground and have it paved with materials that would catch a considerable share of the floating spawn. Were it further made imperative that no shell digging be allowed within a given distance of surveyed and officially recognized beds, the evil would be curtailed as far as it is possible to be. Other advantages to the public beds from the establishment of private culture will present themselves on consideration.

"In this province the requirements for successful oyster culture, namely, sheltered bays and estuaries with sound bottom and the suitable degree of salinity, are everywhere in the three counties, and oysters could be readily planted. Cardigan Bay, King's County, and the estuary of Winter River, Queen's County, are especially well adapted for plantations. Some few favoured localities are as favourable for culture—if planted with proper seed—as the far-famed English coast of Kent.

"In regard to further extending the close season, the following figures may be of use. Summerside is the main port of shipment, sending away two-thirds of the entire catch, but from other ports shipments are also made to the markets of St. John, N.B., Quebec, Montreal, and other places, chiefly in the upper provinces. Supposing the fishermen get to work from 5th to 15th May, they can meet the spring demand, at a high price, say 1,000 barrels. Epicures would perhaps suffer more than the fishermen were spring fishing stopped. From 15th September, when the fishery re-opens, to 30th September, about 8,000 barrels are shipped. In October, say 13,000; in November the same, November being the month in which supplies are laid in for winter. To cut off November would therefore be inconvenient, commercially. In December a few hundred barrels will cover shipments. According to appearance, the fishery had best be amended by strict regulation during the fishing season, rather than by shortening the time of fishing. It is, however, a matter for further consideration.

"Other items present themselves in connection with the public fishing. Such are more clearly defined duties for the wardens; a definite legal size of oyster; the absolute prohibition of fishing through the ice; the licensing of oyster boats; the selection of certain landing places on bays, where only oysters may be brought ashore, so as to bring them under the supervision of the wardens, and, generally, a uniform superintendence of the fishery."

*From annual report, 1889, page 152 : **

"This fishery shows an increase of 5,396 barrels, the total production for the year being 41,257 barrels, as compared with 35,861 barrels in 1888. Warm weather at the beginning of the fishing season somewhat retarded operations for a while, and some of the shipments reached the markets in bad order, causing prices to rule low. October and November, however, were favourable months, and business was more satisfactory. A mild winter and a dry summer were favourable to the growth of the oyster, and beds that have been raked season after season produced the usual quantity. Richmond Bay continues to supply the bulk of the oysters exported, but large quantities were also shipped from the Narrows, Grand River and other places in Prince County. That the

* Inspector E. Hackett.

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oyster fishing of this province can continue for many years to yield the large quantity now taken from it annually is improbable. There is also the possibility of a still larger quantity being required from it in the future. For some years past the supply has been about equal to the demand, a glut in the market only occurring when a protracted period of warm weather forced the shippers to sell their product at any price they could obtain. With the growth of population in the cities and towns of the western provinces it is evident that an increased demand will be created and the fishery will be required to produce a larger supply. The beds in Queen's County are now greatly overfished, and unless proper care is taken the Prince County beds may soon be in the same condition. The protection given by the present close season, while fairly satisfactory, is not sufficient. Large quantities of small oysters are landed during the fishing season, and as they are unfit for shipment, and cannot be utilized in any way, are allowed to rot in heaps, where culled. Action should be taken to prevent this reckless waste, and prohibit the landing of small oysters.

In the interest of the fishery, winter fishing should be prohibited also. Fishing oysters in winter, while of advantage to a few fishermen, is most destructive to the beds, and some of the best beds in the rivers of Queen's County have been ruined by it. To preserve the beds at Orwell, York River, and West River, in Queen's County, decisive action is necessary; and the question of totally closing the fishery on them for a term of years is deserving of serious consideration. Oyster culture might be carried on to great advantage in this province, the numerous rivers and bays of the island being specially adapted for that industry. Large areas, now vacant, could be utilized for the growing of oysters, and, if surveyed and offered on lease, under proper and reasonable restriction would, no doubt, be readily taken up. The system of leasing grounds for the cultivation of oysters in the States of Connecticut, Rhode Island, &c., has resulted in a marvellous expansion of the industry, and it would seem as if the time had arrived when a similar policy should be adopted in Canada. The natural beds should be properly protected, and the control of them retained by the department to be used as a public fishery."

*From annual report, 1890, page 106 : **

Oysters show a decrease of 6,054 barrels, the total production for the year being 35,208 barrels, against 41,257 barrels in 1889. The unusually stormy season caused much loss of time in the months of October and November, thereby reducing the output. The cool season, however, favoured shipments, the products reaching the markets in good order and realizing the highest prices obtained for many years. This industry runs pretty much on the same lines each year. The shippers here supply the same customers from year to year, the product being chiefly sold in the provinces of Quebec and Ontario. The principal fishery is carried on at Richmond Bay, Prince County. The beds of this bay are extremely productive, and although continually raked for years, show no signs of exhaustion, the product in this season, both in quantity and quality being equal to any former one. The Grand River beds have also produced well this year, and are reported as being in good condition. At the Narrows, however, there is some complaint that the size is decreasing, indicating that the beds are being overfished. The beds in the rivers of Queen's County are becoming less productive each year, and are now fished principally for home consumption. To preserve these beds, drastic measures will be necessary, and it appears to me that nothing short of closing the fishery for a number of years will have the effect of restoring them. The only regulation in force in this province at present is a close season, extending from the 1st of June to the 15th of September, in each year. This regulation, while no doubt of great benefit as a protective measure, cannot be considered sufficient to preserve the beds. There should also be a regulation fixing a minimum size, under which no oysters should be landed. At present, large quantities of immature oysters are brought to the shore by fishermen, and as shippers will not buy them, are left in heaps to rot. Such reckless waste should not be allowed. The same may be said with regard to fishing through the ice in winter. This mode of fishing is now largely carried on, and where prosecuted must result in the destruction of

*Inspector E. Hackett.

the beds. The fisherman, by cutting a suitable hole in the ice, immediately over an oyster bed, and using a single long-handled rake or drag, is enabled to raise and deposit on the ice, large quantities of oysters of all sizes, together with mud, &c., from the bed. After selecting all that are marketable, the others are left to freeze and die. This may not be considered any more objectionable than landing immature oysters in the fishing season and allowing them to rot, but the greatest injury is caused by the dead oysters, mud, &c., falling back on the bed when the ice melts in the spring, thus smothering any live oysters which may have escaped the fisherman's drag, and utterly destroying the bed. I would earnestly recommend that a regulation prohibiting the fishing of oysters through the ice be adopted as soon as possible.

"Oyster culture is now extensively carried on in several of the neighbouring States, as well as in the principal countries of Europe. Oyster farming in those places has become an established industry, the seed being planted and the crop raised with the same regularity, and with as great chances of success as attends farming on the land. The oyster being enormously fecund, increases very rapidly; the spat is sent out by the half million, and if the conditions be favourable, matures very quickly. The bays and estuaries of this province afford ample opportunities to the enterprising private culturist who may desire to embark in oyster farming; and as the natural beds cannot be expected to always yield the necessary supply, this branch of industry would, in a few years, become profitable. Definite action with regard to this important matter should be taken at an early day. A system that has produced such marvellous results in other countries should succeed here, and would, if adopted, eventually prove a source of great national wealth."

*From annual report, 1891, page 98 : **

"Oysters show an increase of 5,827 barrels over last year. This fishery was vigorously prosecuted and proved very successful. Stormy weather about the last of October prevented fishing for awhile, but this had the effect of increasing the demand and raising prices, thus eventually benefiting the fishermen. The oyster fishery has exhibited no change for some years past, the beds in Richmond Bay, Grand River and the Narrows yielding the usual quantity, although incessantly raked during the fishing season. The product is sold in the other provinces of Canada, chiefly in Ontario and Quebec.

"Fishing through the ice is becoming an established industry here, and if allowed to continue, will result in great injury to the fishery. This practice has only been introduced within the last few years, and its bad effects are not yet apparent. There is a strong feeling against this mode of fishing entertained by those who are interested in the preservation of the beds.

"Mr. Venantius S. Gillis, one of the most intelligent guardians on Richmond Bay, writing me a few days ago on this subject, states :

"I have also to state that as soon as the ice on Richmond Bay was strong enough to bear a person, there were several crowds out oyster fishing.

"The method used in winter fishing destroys the ground, so far as oysters are concerned, for a great many years, if not forever. They use a machine like a common hand rake with curved iron teeth in the head and with a handle about forty feet long. With this they scrape the bottom in a circle all around the hole cut in the ice, bring mud, oysters, &c., in a heap directly under the opening, and then fish the oysters up with the common tongs or rakes. To tear up the bottom in this way destroys the oysters. The oyster grounds should be rigidly protected, as the oysters are a large revenue to poor people and others. The season for fishing is too long and will in a very few years exhaust the beds by overfishing. The only way I can see that they can be saved is to stop the winter fishing and extend the close season until the 1st of October in each year. I have been speaking to several of the fishermen and they concur in the same idea."

"In addition to the destruction complained of by Mr. Gillis, large quantities of immature oysters are destroyed each year. These small oysters are landed by the fishermen and, being unfit for export, are rejected by the buyers and thrown in heaps to rot. I would earnestly recommend that a regulation be adopted by the department, fixing a

*Inspector E. Hackett.

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" Several of the foreshores on the bays and rivers of this province, where oysters at one time existed, but where no public fishery is now carried on, might be utilized for cultivation. The department has lately adopted the system of leasing or licensing those blank spaces to private parties for purposes of oyster culture, and it is probable that numerous applications will be made for areas of this kind.

The proper protection of the beds in the close season is attended with considerable difficulty. There is always a demand at the saloons for oysters during the summer months, and unprincipled parties make great efforts to supply them. They generally repair to the beds in the night time and, after securing sufficient to meet the demand, convey them to the parties in small cans. This practice has been found very difficult to prevent, and may be carried on in the immediate vicinity of the guardian's residence. The beds, however, were fairly well protected last season, and while a little of this smuggling may have been done, open poaching was not allowed."

*From annual report, 1892, page 92 : **

" Oysters show a decrease of about 8,000 barrels. Owing to windy weather in September, the catch was not so large the first part of the season as in 1891. This had the effect, however, of raising prices later in the year, and the men engaged in the industry were well satisfied with the result of the season's operations. Richmond Bay is the best oyster ground in the province, and although continuously and incessantly raked, still produces large quantities of this excellent bivalve. The bottom of this bay appears to be covered with oysters, and the men are each year discovering large and productive beds, which they assert have never before been worked upon.

" In this way new ground is being opened up, and the danger of exhaustion by over-fishing is not so great as in the smaller bays and rivers. The number of boats and men employed is, however, increasing from year to year, while the output remains about the same.

" This would indicate that the supply is kept down to a very low point, and unless nature is assisted in some way may ultimately fail.

" The small shallow streams have certainly suffered from overfishing, and in many of them the industry has ceased to be remunerative. The mud diggers have been largely used in the vicinity of living beds, and have without doubt caused great injury to the growing oysters. Another practice that should be prevented is the landing of young oysters by the fishermen during the season. These immature oysters, being too small for export, are rejected by the buyers and thrown out to rot.

" Hundreds of barrels are wasted and destroyed in this way each season, which, if returned to the beds, would mean thousands of barrels of the best oysters another year.

" Stringent regulations prohibiting the use of mud-digging machines within a certain well-defined distance of a living oyster bed, and compelling fishermen to return all small oysters to the water, should be adopted by the department with as little delay as possible."

NOVA SCOTIA.

In the year 1888, Mr. Rogers, inspector of Nova Scotia, reports as follows (page 25) :—

" I am informed that the local Government of this province (upon what authority I cannot say), granted a lease of certain oyster beds in Malagash Harbour to Alexander Macfarlane, Esq., of Wallace, for the purpose of cultivating oysters. The inhabitants generally are very much opposed to any such grant, as the mussel beds, and the mud on the flats is invaluable for manure, and the granting of these privileges to Mr. Macfarlane has entirely deprived them of its use.

" I am not prepared at present to say whether the right to cultivate oysters may not be held by private individuals without interfering with the manure referred to.

*Inspector E. Hackett.

When the ice goes out in the spring I will be able to judge better. It is a matter of considerable importance and very desirable to encourage, as far as possible, private enterprise in this as well as many other branches of our invaluable fisheries, and I have no doubt that oysters may be profitably cultivated, not only at Malagash, but Wallace, Tatamagouche and Pugwash as well, and I hope the day is not distant when private enterprise will develop this branch of our natural resources, to the advantage of the province, as well as to all concerned."

*From annual report, 1879, page 154 : **

"Oysters do not figure largely in the general produce of our fisheries, and unless they are afforded better protection from indiscriminate destruction than the present law provides, we shall very soon have none to report. There are tens of thousands of acres of waters along the estuaries and bays, around the Straits of Northumberland, particularly, where these fish could be cultivated in great abundance, and at small cost. It is surprising that some enterprising persons do not take hold of this business. Our American neighbours are doing a very large business in this line, amounting to many millions of dollars annually. We have every facility for their cultivation and a ready market at remunerative prices. Information on the subject among the people is much needed, and I intend in future to turn my attention more to this matter, and, if possible, induce some enterprising persons to embark in the business; others will soon follow, no doubt, as very little capital is required, and the profits are large."

*From annual report, 1885, page 86 : **

"Oysters are found to some extent in many parts of Nova Scotia proper, and in Cape Breton, and might be cultivated to almost any extent. Many persons have commenced to form beds on a small scale, and if reasonable success follows their efforts, many others will engage in the business and, in time, there is a probability of the creation of a large industry. I would recommend that leases be granted where proper efforts are made in this direction, for the purpose of encouragement and to prevent encroachments."

BRITISH COLUMBIA.

From annual report, 1885, page 275 :

"15. Mr. J. McLeod reports that he has planted native oysters on the beds he wishes to lease and that they are doing well. He has already sold twenty barrels, and says the only thing which deters him from importing other seed is the non-receipt of the lease applied for. I would respectfully recommend that his application may be favourably considered."

"16. Mr. A. J. McLellan reports that the oyster bed under lease from the Government is satisfactory from present appearances; with the exception of taking a few from the beds to ascertain the growth and watch the spawn, they have not been disturbed. It is his firm conviction that they have thrown out spat as he finds thousands of young fry attached to the shells. He says: 'But must wait for further developments to prove that it is the spat from the imported oysters, they have the natural signs of the imported ones, yet may be the spat of the small native oyster found in the same waters. In order to test the matter, I intend to fence in and protect a few imported oysters in the month of March next, so that in my next report I will be in a position to inform you of the actual developments.'

From annual report, 1887, page 250 : †

"Our oysters are of small size, and only taken in sufficient quantities to meet the local demand. Owing to this, a great deal of those used to supply home consumption are imported from oyster beds at Olympia. These oysters are considered of better quality and finer flavour than our own, which is attributed to cultivation and care. Sometimes a few of the transplanted eastern oysters are imported from San Francisco. They are

*Inspector Roger.

†Inspector Thomas Mowat.

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of good size and look healthy, but are not deemed as good as those taken fresh from the Atlantic. We have a number of defined beds on this coast, but for want of proper care and attention they have deteriorated and are now almost worthless.

" Two leases for oyster beds were granted to parties in this province, viz.: One to the Mud Bay Oyster Company, and the other to A. W. McLellan, Victoria Arm. I am informed that it is the intention of the former company to clear the beds and stock them with eastern oysters during the coming season. Mr. McLellan imported a lot of Atlantic oysters to stock the Victoria Arm, and I have written him several times for a report which he promised, but so far he has neglected to send it. I understand, however, that the venture was not a success; the location being found unsuitable, the 'spat' perished."

*From annual report, 1888, page 242 : **

" Oysters.—These have been taken in larger quantities within the past year; the beds are limited and the variety small. The largest portion of the catch was taken from the Vancouver Island beds. The Victoria Arm lease has been dropped; the imported oysters which were planted there proved failure.

" Referring to Guardian Lomas's report, I would recommend that an annual close season be adopted for this province, from 1st May to 31st August, both days inclusive; that a license fee of ten cents per barrel be placed on all oysters fished exclusive of those taken on leased beds, and that a regulation be made defining the size of the oysters that should be marketed."

*From annual report, 1889, page 253 : **

" Oysters were consumed in increasing numbers, and as the beds are limited, and the variety small, the demand is always in excess of the supply.

" The beds where these mollusks are now caught are few in number, the principal ones being Chemainus, Sooke and Comox. Guardian Lomas reports that if the modes of fishing, as at present practised, are not changed, the beds will be ruined."

*From annual report, 1890, page 185 : **

" The supply of oysters has increased by about 500 sacks over that of 1889. A sack contains two bushels. The supply is still very short of the demand. This is becoming more apparent every season, as the population increases, which causes the importation of large quantities of oysters from the Sound bed.

" Fish Commissioner Crawford reports that 345 acres are under artificial cultivation in the State of Washington, with an average output of 350 sacks per week during eight weeks in the year, giving employment to about 125 persons, and worth to the State, \$21,888. It is well to know what our neighbours are doing, that we may profit by their experience. The regulations adopted by the department for the cultivation of oysters is a move in the right direction, which will be the means of restoring a number of depleted beds to a state of productiveness."

The following are extracted from a report submitted to the department by special commissioners, on the oyster fisheries of the maritime provinces:—

REPORT ON THE OYSTER FISHERIES OF CANADA.

The Honourable G. E. FOSTER,

Minister of Marine and Fisheries.

SIR,—The commissioners appointed by His Excellency the Governor General in Council, of date 4th July, 1887, namely, Mr. Edward Hackett, of Tignish, Prince County, province of Prince Edward Island, honorary chairman; Mr. Alfred Ogden, of Halifax, Nova Scotia; Mr. W. B. Deacon, of Shediac, in the province of New Brunswick; and Mr. John Hunter Duvar, of Prince County, province of Prince Edward Island, acting as secretary, beg to report:

* Inspector Thos. Mowat.

Said commissioners were nominated to inquire into and report upon the lobster and oyster fisheries of the Atlantic maritime provinces of the Dominion of Canada, and to offer recommendations for the preservation and development of these fisheries.

The lobster fishery of the Dominion is the subject of a separate report, and is of this date laid before Your Honour.

The commissioners have personally visited the greater number of the oyster grounds in the four provinces margining the Gulf of St. Lawrence, and have to express their view that the live oyster beds are of much larger extent than they anticipated, and, if judiciously supervised, must form a not unimportant item in the national resources of Canada.

The quality of the oysters on the natural live oyster beds of the lower provinces varies much, owing to the nature of the bottom in oyster waters, the depth, and differing salinity of the water, the shelter, thermal difference, and other natural features that have a bearing on the case.

Along the greater part of the shore of the Gulf of St. Lawrence, east of Gaspé, are evidences that oysters once existed in immense quantities, as is shown by deposits of dead oyster shells, which in places are not less than twenty feet in depth. In some places (but not in all) these beds could be replanted or revived.

The decadence (death) of the oyster in these places is explainable by the encroachment of the sea on the shifting beaches, by the clearing away of forests, altering the shallow margins of the shores, and from other causes too obtruse for the commissioners now to go into.

The commissioners have, however, found that the natural live oyster beds of the provinces of New Brunswick and Prince Edward Island, and perhaps of Cape Breton and elsewhere in Nova Scotia, are of large value as a fishing resource, and that there is much ground available in all the Atlantic maritime provinces for profitable private culture under a liberal system that would induce private persons to devote their care to the industry.

The oyster fishery is different from lobster and other fisheries in that it is prosecuted without expense. A boat worth \$10 and an oyster-tongs, costing \$1, are all the material required. So far as the commissioners can learn there are no vessels specially built for the oyster trade. Large numbers of schooners move annually to the oyster beds and fish them with their own crews, but these vessels are a part of the ordinary coasting marine and cannot be taken into account as part of the oyster fishing plant. It may be mentioned that for want of a system of registration or license, no account can be obtained of the quantities taken by this fleet of one or two hundred sail. It is, however, evident that much greater quantities of oysters are taken than appear in the official returns. And it is not too much to say that half as many young oysters are destroyed by reckless fishing as appear in the Blue-book. Say a further 20,000 to 30,000 barrels recklessly destroyed annually without benefit to any one, and to the great detriment of the beds.

In the absence of any system of registration, the value of plant employed in the Canadian oyster fishery is a matter of mere calculation. Perhaps the following approximates as nearly as possible to accuracy:—

	Value.	Produce last year.
P. E. I.—650 boats and tongs.....	\$10,650	23,125 barrels
N. B.—550 boats and tongs.....	6,150	28,083 do
N. S.—80 boats and tongs.....	880	1,397 do
Total.....	\$17,180	62,605 do

An outfit (total first value) of \$17,000 would cover the whole oyster fishery,—giving partial employment during three months to perhaps 1,500 men, who may be described as only "occasional fishermen."

The boats are not used solely for oyster fishing. They are the ordinary all-work boats that every farmer with a water-frontage possesses.

In addition to the floating plant, about sixty thousand barrels are annually required, but these are empty flour barrels at 12½ cents apiece.

It will thus be seen that the oyster fishery is carried on without capital.

There is no regulation of the fishery whatsoever, excepting a close season from 1st June to 15th September, inclusive; and shore wardens without boats are utterly powerless to check poaching in the close season.

A series of charts of existing oyster beds and of probable oyster grounds would necessitate prolonged and expensive actual survey, and should be made under the care of a general superintendent of oyster culture.

The commissioners, having carefully gone over the evidence, beg to make the following observations and recommendations:

They would respectfully recommend to Your Honour's consideration that one general law or regulation should cover the whole of the Canadian Atlantic sea-board, with the following provisions, namely:—

I. That existing oyster beds be reserved to the public, and that their limits be officially defined;

II. That mud-digging be prohibited within sixty yards of any officially recognized workable live oyster bed;

And that suitable portions of bays, creeks, estuaries or harbours be considered closed for oyster fishing, and said closed portions be laid off for the digging of shell manure;

III. That bays of considerable extent in which are many oyster beds be marked off in two or more divisions, and that the divisions be fished only in alternate years;

IV. That for the present, the present close season be retained, namely, from 1st June to 15th September in each year, both days inclusive;

V. That under penalty of forfeiture of boat and appurtenances, to fisherman shall bring ashore (excepting for authorized purposes) any "round" oyster that does not measure fully two inches in diameter of shell, nor any long (oblong) oyster that does not measure fully three inches of outer shell, and that possession of such undersized oysters by any person shall be punished by fine;

VI. That all winter fishing be prohibited for oysters (Commissioner Ogden dissenting);

VII. Temporary or permanent proclamation to close localities where the supply is so nearly exhausted as to warrant closure.

VIII. That under section 21, subsection 4 of the Fisheries Act a liberal inducement be offered under a system of leases to persons who will undertake under stringent regulations to grow oysters on private beds. That is to say,—that a lease be given (under bonds), for not more than nine years (renewable) at a nominal rent for the first three years, conditional on a sufficiency of brood oysters being planted on the area within one year after date of the issue of lease. The Government to have a lien on such planted beds;

IX. Easy and inexpensive arrangements, by which persons owning water-frontage may lease their own foreshores for oyster culture from the Government;

X. That Parliament be invited to appropriate a sum or sums for the formation of oyster beds in various waters and places found adapted for that purpose, and for transplanting oysters, and re-stocking exhausted fisheries by natural or artificial means—in accordance with section 21, subsection 5 of the Fisheries Act;

XI. The appointment of a responsible officer of fisheries, capable of the position, and to rank with the Superintendent of Pisciculture, as General Superintendent of Oyster Fisheries, and to have general superintendence of all public and private oyster culture;

XII. A system of registration of oyster boats, with other details to be arranged by the department.

With reference to clause XII., Mr. Commissioner Ogden moved the insertion of the word "free" system of registration, &c.

Mr. Commissioner Deacon moved, seconded by Commissioner Duvar that the annual registration fee for oyster-fishing boats be one dollar—Carried. Mr. Ogden dissenting.

All of which above written report is respectfully submitted.

Dated at Shédiac, province of New Brunswick, the fifth day of November, A.D., 1887.

EDWARD HACKETT, *Chairman,*

ALFRED OGDEN,

W. B. DEACON,

J. HUNTER DUVAR, *Secretary.*

ADDITIONAL REMARKS ON THE OYSTER FISHERY.

(By the Secretary of the Commission.)

The enormous extent to which the culture of oysters has been developed on the coasts of some of the Atlantic States of the United States, as well as on the shores of France and Holland and, in a lesser degree, of England, indicates the oyster as a great industrial and national resource. Not every sea-bottom is suitable for oyster culture. The commissioners heard somewhat vague reports of unsuccessful attempts to plant oysters at Caraquet, N.B., Gaspe, Que., and elsewhere in New Brunswick and Quebec. To propagate oysters successfully requires bottom of a certain degree of hardness, free from mud or alkali or sea-vermin, not washed by strong tides nor exposed to being silted over by storms, and with several other minor requisites of detail. The degree, greater or less, of salinity in the water is all-important and can only be judged by an expert and be ascertained by scientific means. A water temperature of 68° to 70° at spatting time is also essential. Salinity and temperature vary in almost every bay and estuary, according to depth and bottom and inflow of streams. The size, shape and quality of the oysters themselves vary so much in different bottoms that fishmongers can tell on looking at an oyster in what waters it was found. All of which knowledge—as well as much other information—would require to be possessed by the superintendent of oyster culture.

Section 21, sub-section 4, of the Fisheries Act authorizes the Minister to grant special licenses and leases for any term of years to any person who wishes to plant or farm oyster beds. This gives the Minister unlimited power as to the length of lease. But in section 4 of the same Act his power of granting leases for other fisheries is limited to nine years, excepting under the authority of the Governor in Council.

Any innovation—however beneficial, and especially if it touches fishermen—has to battle against prejudice. Much alarm is already expressed at the bare supposition that oyster beds may be leased, and already is rising the parrot-cry of "monopoly."

Nor is this fear altogether without some faint shadow of excuse. The natural history of the oyster will explain it thus: Natural, or sea oyster beds are not stationary. They throw off "spat," like bees swarming, which "spat" forms other smaller or larger beds, at a greater or less distance around the circumference of the old bed. The fishermen fish out the old bed and then hunt for these new ones. It is obvious that if all the vacant water were taken up by private cultivators the fishing area of the public fishermen would be restricted. There is another, not now threatened but positive to occur in a few years hence, namely, the market for oysters is subject to fluctuations, and the public fishermen know nothing of these fluctuations until they offer their oysters to the dealers for sale. The consequence is that at times there is a glut of supply and the shippers will not purchase at any price (therefore the oysters are spoiled) while at another time they are in demand at increased prices. Private cultivators—having a sure "monopoly" for twenty years, or other long term, and who would know where to lay their hands on oysters at half-an-hour's notice, instead of hunting all over the bay for them—would watch the market and supply the demand, thus cutting out the public fishermen. Private culture would thus compete at an advantage over public fishing.

A lease granted for so long a period as twenty years is virtually given away, and practically represents a freehold. After the first four years it becomes a valuable piece of real estate to the fortunate possessor. For the first three years it is all outlay. In the fourth year the first fruits should pay interest on the outlay, but its value increases year by year. The value of the lease or license in the fifth year bears no comparison in value to what it should be in the ninth year, and the ninth year is but trifling in value in comparison with what it ought to be in the fifteenth or twentieth. Government to give a lease at a low or nominal rent for a longer period than nine years would be robbing itself.

Areas for oyster culture are certain, sooner or later, to become the objects of active speculation. For this reason they should be put under the strictest supervision to see that they are planted, *bona fide*, with the requisite quantity of brood fish, and otherwise attended to. This is a matter of importance, inasmuch as the areas fall back into the

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To properly supervise oyster fishing throughout Canada demands a special class of fishery officers (with boats) distinct from the ordinary fishery wardens. Without boats they are nothing. This, however, is a matter of detail. Whatever arrangement is made should be placed under one responsible head officer.

As regards the size of leased areas, it must wholly depend on locality, especially on tides. Four acres of productive oysters is a small fortune, and even one acre would afford a fair income, but a much larger space must be included within the lease, to leave free space for the fall, drifting and collection of spat. At the Yerseke leased oyster beds in Holland the leased plots range from 12 to about 150 acres, and the term of lease is fifteen years, at the end of which term, namely, in 1885, all the areas reverted to the Government, and were re-let at much enhanced prices. The term of fifteen years is too long for Canada, but the principle is the same. All of which shows that the superintendent under whose care the Canadian oyster fisheries shall be placed should be an expert.

Attention is directed to the address of Professor Hubrecht on "Oyster Fisheries in the Netherlands," delivered before the conference of the International Fisheries Exhibition, at London, 1883; and to the annual reports, for various years, of the Shell-fish Commissioners of the State of Connecticut, U.S., for information of the proceedings of the commission as to oysters and surveys of areas for oyster fishing. Also to report of United States Fisheries Commissioners for 1876, pages 271 *et seq.* And Canadian Fisheries Blue-book for 1873, pages 197 *et seq.*

2.

The regulations for both public and private oyster beds in France are too tyrannical for this freer land of Canada, and the rules adopted in the Netherlands have too much Dutch stiffness for us more *habile* Canadians. Canadian regulations should rather be framed on the more practical methods in use in the oyster States of the United States.

In the State of Maine, persons wishing to cultivate oysters on the banks of bays or creeks belonging to the State must first obtain a permit from the local authorities. The only exception is in favour of plantations situated in the interior of bays and gulfs. In no case must navigation be impeded.

In Massachusetts, on payment of fees, permits for *twenty* years to plant oysters in vacant waters may be obtained from the mayor and selectmen of each maritime locality, but the national beds must be respected.

In Rhode Island (Providence River) the commissioners of shell-fisheries can grant vacant water for *five* years—and the beds pay an annual tax to the State. In no case can more than *one acre* be assigned to any one person, and only *one acre* per head to members of a company cannot be sublet. No definite term of lease.

In Connecticut a licensing committee, nominated by the people, grants licenses of vacant water for oyster culture. The extent of ground occupied by any one person must not exceed *two acres*. Committees specify the term for which such license may be held.

In the State of New York all land-holders on the banks of Harlem River have the right to plant oysters on their foreshore. In Jamaica Bay, L.I., the same, but no individual nor association can occupy more than *a quarter of a mile* of the foreshore.

In New Jersey, proprietors of tidal waters may use it for oyster culture.

In Delaware, any citizen of the State (but no foreigner) may inclose *one acre* for oyster culture, provided the public beds be not touched.

In Maryland the regulations are the same as in Delaware, namely, *one acre*. Owners of shore frontages have priority of choice.

No information as to Virginia.

3.

With reference to vacant waters and the likelihood of more or fewer natural oysters being found on areas allotted for private culture, thereby causing jealousy and irritation, the following note is appended to the United States Commissioners' report on natural

oyster banks or beds, 1876, page 297. The same contingency is covered by section 21, subsection 4 of the Canadian Fisheries' Act, which says: "And the holder of any such lease or license shall have the exclusive right to the oysters produced or found on the beds within the limits of such lease or license." The note says: "By a natural bank (or bed) we mean a conglomeration of mollusca presenting a character of continuity, constituting what is usually called an oyster bed. The natural bank may be single or formed of several small banks, separated by greater or smaller spaces, but always sufficiently connected to be considered parts of one whole. As to places where, through accidental circumstances, isolated oysters have developed, they are not classed among the natural beds, since, if this were the case, the largest part of the submarine soil of the coast would be under interdiction and oyster culture would be impossible. However protective the American laws may be in what concerns public property, they are careful not to interfere with private enterprise by a too rigorous interpretation of the term '*public property*.'"

4.

Since the commissioners visited Bay du Vin, N.B., 60 and 70 vessels have been daily fishing and taking away large supplies from the already impoverished beds. The same depletion is going on at several other places.

5.

There are several lagoons and sheltered coves among the Magdalen Islands, where it is believed oysters could be grown successfully, and thereby in the course of a few years, afford a new industry to the rather shiftless and unenterprising population. Frequent shells of oysters are washed up near the Columbine Shoals, thus indicating that oysters have been, or are now, in that locality.

6.

During the past six or eight years, several applications for lease of sea areas for oyster culture have been forwarded from Prince Edward Island to the department, and are on file. The hydrographic system of the province is peculiarly suited for oyster growing, the narrow island being interlaced with tidal creeks and there being no spot of land more distant than eight miles from tidal salt water. Prince Edward Island has also more population to the square mile than any other part of the rural districts of Canada. Almost all the farms are laid off 5 chains and 10 chains in width, and whenever practicable the frontage faces on salt water. The tenure is freehold. This gives an enormous number of claimants who might have the right to take up leases under section IX. of the commissioners' report, and when the matter comes to be understood by the public it is probable that many applications will be received from Prince Edward Island.

7.

COST OF A PROTECTIVE SERVICE.

Although it is beyond the mission of the commissioners to surmise what course the Government may deem it proper to adopt, the following is offered as an estimate of what a thoroughly efficient protective service for the Canadian oyster fisheries would cost annually:-

1 General Superintendent, salary.....	\$ 1,800
His expenses	400
1 Overseer	600
His expenses	300
1 Travelling Overseer (as detective). .	400
His expenses, a like sum.....	400
Clerk	345
1 Surveyor, paid for his work, say.....	600
12 Oyster Wardens, with boats, viz.:—4 in Prince Edward Island ; 6 in New Brunswick ; and 2 (without boats) in Nova Scotia, at \$150 ; Prince Edward Island and New Brunswick at \$250..	2,800
Cost of 10 boats at \$35.....	350
Wages of boats' crews, 12 men at \$60 per season.....	1,080
Total, say.....	\$17,000

Against which, as a set-off, any license or registration fee, or oyster tax, or lease of private grounds.

8.

STATEMENT of the catch of oysters in Canadian waters, from the year 1870 to 1886.

Year.	Catch. Brls.	Year.	Catch. Brls.
1870.....	Have no record.	1879.....	28,632
1871.....	39,450	1880.....	34,348
1872.....	Have no record.	1881.....	31,498
1873.....	27,288	1882.....	54,646
1874.....	14,318	1883.....	50,540
1875.....	11,716	1884.....	41,956
1876.....	16,856	1885.....	57,132
1877.....	29,576	1886.....	62,905
1878.....	30,090		

1887—(P. E. I., to date, 30,000 barrels or upwards.)

J. HUNTER DUVAR.

Secretary of Commission.

From annual report, 1889, page xxii. Extracts taken from Deputy Minister's report :

THE OYSTER FISHERY.

Its Condition and Restoration considered.

" Only about \$165,000 worth are annually produced in the provinces of Nova Scotia, New Brunswick and Prince Edward Island, fully two-thirds of which are taken in the last-named province. It is claimed that, of all the oysters consumed in Canada less than one-third is supplied from native sources.

" There is no sufficient reason why the demand for oysters throughout the Dominion should not be supplied by our own people. The inland markets are easily accessible, and the domestic consumption would, no doubt, be increased if the article was produced and supplied with our own resources, at a lessened cost. The area of oyster grounds on the Canadian coasts is very extensive, and is situated in localities admirably adapted for the growth and nutrition of oysters. This mollusk has been found from Bay des Chaleurs to Bay Verte, in the following places, viz.: Between Caraquet Banks, at Caraquet, St. Simon, Shippagan Harbour and Gully, Tabusintac, Burnt Church, Bay du Vin, and many other places in Miramichi Bay; Kouchibouguac, Richibucto, Buctouche, Cocagne, Shediac and Bay Verte. In Nova Scotia, the oyster is found at River Philip, Pugwash, Tatamagouche, River John, Pictou, Tracadie, Mabou, Margaree, Sydney, Albert Bridge, Country Harbour, St. Mary's River, Liscomb Harbour, Jeddore Head, and nearly everywhere in the Bras d'Or Lakes. It is found around the whole coast of the Island of Prince Edward, and many places in British Columbia are also adapted for the growth and cultivation of oysters.

" In most of these places there are remnants of a stock which, for delicacy of flavour and nutritive properties, is not excelled by the choicest varieties grown and caught on the United States' coasts. Along the whole tidal shores of Prince Edward Island, and New Brunswick especially, oysters of the finest description might be raised in enormous quantities were the natural facilities for their culture enhanced by a proper system of cultivation and protection. When it is borne in mind that the mother oyster yields nearly 1,000,000 of spat each season, some slight conception may be formed of the probable return from any careful system of cultivation.

" In 1880, this industry yielded in the States \$13,403,852, eighty per cent of which came from Chesapeake Bay. This high state of productiveness has been attained only by an economic use of existing oyster grounds, accompanied by careful and intelligent

cultivation, after the areas of oyster shores had been apportioned among private individuals and regularly farmed. Similar results would be attained by like measures adapted to the oyster fishery on the shores of the maritime provinces.

"In 1881, in France, 29,431 men, women and children were employed in taking 374,985,770 oysters from September to June, worth 12,061,753 francs, equal to \$412,350. This was from public grounds alone, independent of private beds.

"The strict observance of the decrees of 1852 in the conduct of the fisheries may be regarded as having contributed largely to the success of the oyster culture in France and to the actual prosperity of this industry. These decrees, the wisdom and opportuneness of which the event has demonstrated, were intended to stop the spoliation and exhaustion of the oyster beds, and subject their exportation to strict regulations. The persevering application of these measures, the care unceasingly renewed, the encouragement and the example which the Administration of the Marine continually gave, resulted in bringing about the restoration of the natural beds which were approaching exhaustion, and in invoking a revival of oyster culture by private individuals.

"In England, in 1883, the value of oysters taken was nearly \$10,000,000—(\$2,000,000).

Professor Huxley, Sir James Caird and Mr. Shaw Lefebvre reported to the English Government about the year 1863, calling attention to the failing off of the supply of oysters from the failure of spat. They recommended the acquisition by individuals or companies of sea-bottom for oyster culture.

"Mr. Archibald Young, inspector of Fisheries for Scotland, in a report on the oyster and mussel fisheries, remarks that: 'Promiscuous and ill-regulated fishing on any bed or scalp to which oysters or mussels are attached simply means the extinction of these oysters or mussels in a longer or shorter space of time—especially if no close season is observed, and if immature fish are carried away and sold, instead of being returned to the bed.'

"The secret of the whole matter is that, where oyster and mussel cultivation has proved successful, the person undertaking the same has obtained a concession from the Government to work the beds exclusively himself, and has not been hampered by other persons claiming a right to fish on his grounds; in other words, fishings are worked in precisely the same way as farms on the land, where the farmer sows his seed, and at the proper season reaps his crop. The allowance of the general public to fish for oysters or mussels without restrictions or regulations means the inevitable destruction of the beds—some sooner, some later.'

"During the course of an interesting debate which took place last session in the Senate regarding the oyster fisheries of the Dominion, Senator Poirier brought the subject to the notice of the Senate, and especially alluded to the great destruction caused by winter fishing through the ice when small oysters and spat are destroyed in great numbers. Senator Macfarlane, whose great experience renders his views important, pointed out the hardship which the prevention of winter fishing would cause to many people. He, however, strongly advocated the restoration of exhausted beds by the Government.

"A special commission, appointed in 1887, to investigate the condition of the oyster fishery in Canada, among several recommendations and suggestions as to the necessity for additional regulations to ensure the preservation and improvement of this important industry, shows that, upon personal examination of the oyster beds, they learned with surprise of the great extent of the area suitable for oyster culture in the Dominion. Many of the beds were found extinct, while others were rapidly becoming exhausted, from want of proper cultivation and protection from indiscriminate and improvident raking.

From Deputy Minister's report, 1890, page II. :

OYSTERS.

"The state of the oyster fishery in the maritime provinces of the Dominion has already attracted not a little attention on the part of those interested in its preservation.

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"A commendable effort has been made by a few persons towards the introduction of oyster culture by private enterprise, and the effort has, the department is informed, been reasonably successful. It has, however, become apparent that if this fishery is to be saved from extinction, radical regulations, looking to a less destructive mode of carrying it on, are imperative, as already some of the beds in the provinces of New Brunswick and Prince Edward Island, which, not many years ago, were conspicuous for their oyster production, have either become wholly exhausted or so nearly so as to render fishery operations no longer profitable. Notable amongst these are the once prolific beds of the harbour of Shediac, N.B., and although these beds gave unmistakeable signs of exhaustion many years before its accomplishment, an effort made by the Minister of Marine and Fisheries in 1875, looking to their preservation and resuscitation, met with so much opposition in the district that it was abandoned.

"The existing reasons for the depleted state of the oyster fishery are so fully referred to in my annual report of last year that any repetition of the facts appears uncalled for.

"In 1885 the close season for oyster was extended from the 1st to the 15th of September, and the season is now fixed, by regulation adopted on the 6th of August, 1885, at from the 1st day of June to the 15th day of September in each year. This is the only regulation in existence bearing upon the oyster fishery in the Dominion. The fishery has been relentlessly pursued, and may yet be, till the new regulations take effect, by any persons who see fit to rake oysters at any place and in any manner they please, and wholly regardless of the size of oysters taken or the injury to existing beds, by leaving large numbers of small oysters and shells on the ice, in the spring of the year to drop upon and destroy the beds.

"Recently, the undersigned has had the advantage of perusing, among other documents, a very interesting and recent work upon the "Economic Mollusca of Acadia," written by Professor W. F. Ganong, a native of New Brunswick, at present a lecturer in the University of Harvard. Mr. Ganong reviews the condition of our oyster beds, and says: 'There are two futures open to the oyster industry of Acadia; free fishing by the people and a lingering death, or a vigorous Government interference, and a great and lasting prosperity. This is the kernel of the whole matter. Government interference. It has worked well in other countries; it would, under the same conditions, work well in this. The duty of the Government, if it take charge of it, would be two-fold; to regulate the fishery on the public beds, and to give encouragement to culture by corporations and individuals.'

"As to the first, the position and extent of beds must be determined, and each one given a period of rest, being fished not oftener than once in three years; the close season should be vigorously enforced; fishermen should be made, under heavy penalties, to return to the water all oysters under certain sizes; mud machines must be restricted to certain places in each district, being given ample liberty, but not allowed within a certain distance of a living bed; mills must not be allowed to discharge saw-dust into the water within a long distance of a living bed; fishing through the ice should be regulated, so that refuse cannot be allowed to fall on the beds. As to the encouragement of culture, laws should be enacted which would give to a culturist as good a right to his product, and as full protection from theft, as has a farmer. Areas in good localities should be set aside and leased for long periods; but, as a rule, the public beds should not be trespassed upon. Some beds should always be reserved for public fishing; freedom to take wild game, under common-sense conditions, the Dominion should be very slow to take from its citizens. Private individuals should be encouraged to take their seed oysters from our own beds, as there are none better, nor so good, for our climate.'

"The undersigned observes that in France and in the British Isles, as well as in some parts of the United States, the oyster beds are divided into public and private fisheries, and a leasing or licensing system prevails in these countries.

"It was evidently the intention of the Canadian Parliament, so long ago as 1868, to encourage in the same way the development of this important industry, as witness the provisions of 31 Victoria, cap. 80.

"By this Act Parliament provides for the granting of licenses or leases for the exclusive right of fishing oyster beds in any of the bays, inlets, harbours, creeks, rivers, or

between any of the islands of the coast of Canada. It provides for the expenditure by the Minister of Marine and Fisheries of all sums appropriated by Parliament 'for the formation of oyster beds in various waters and places found adapted for that purpose, and transplanting oysters.'

" This Act further provides that shell-fish fisheries shall be subject to any regulation or regulations to be made under the Fisheries Act.

" Regarding leases the Minister of Justice expressed the view that 'the instrument given should take the form of a license rather than that of a lease, inasmuch that it might be contended that, by an instrument of the latter kind, the department intended to give possession of the sea-bed as distinguished from a license, and the owner, whether the Dominion or province, or a subject, might contend that such an instrument interfered with the rights of the owners in fee. If the instrument take the form of a license, it will be of the same utility to the holder as a lease; but the holder, instead of having an estate in the soil itself, would only have an exclusive franchise or right of user for the purposes mentioned in the statute.'

" It is therefore apparent that, so far as legislation goes, it is possible to regulate in Canada the fishery as effectively as is done elsewhere, and much can be accomplished under a proper system of regulations.

" In dealing with this matter it is essential to remember the large field open to Canadians for profitable enterprise. The area on the Canadian coast suitable for oyster culture is enormous.

" In 1878, 30,000 barrels were taken in Canada, valued at \$90,270; and in 1882, 64,646,

" Prosecuted with greater energy than ever, and by more people, this fishery produced in 1888 only 56,234 barrels, valued at \$163,902, being less than in the years 1897, 1886 or 1882. The consumption or demand for oysters in Canada is considerable, there being imported in the year 1888 as many as 1,698 barrels, 234,502 gallons shelled in bulk, and 198,548 pounds canned or preserved.

In a report made to the Minister of Marine in France by Mr. Brocchi, relative to oyster culture on the shores of the channel and of the ocean, and published in the *Journal Officiel de la République Française*, of the 8th November, 1881, it is stated, when alluding to the success of the industry, that 'the experiments to which the State devoted considerable sums produced great effect.'

" Attention should be directed to the Basin of Arcachon, where experiments have been crowned with wonderful success and to which the undersigned desires to call special attention. In 1863 oysters existed in a natural state in this basin, but ignorance and want of foresight had hitherto produced bad results. 'The natural beds were silted up with mud, and the oysters were rapidly disappearing.' The Government rented parts of the basin for culture, and in 1886 one of the places rented, that of Luhillon, four hectares in extent, furnished more than 5,000,000 oysters. The effect of this was to induce applications for concessions, which greatly increased. In 1879 one of the Government reserves (200 hectares) furnished 25,000,000 oysters. The Basin of Arcachon which, in 1858, only furnished oysters to the value of £100, in 1888, after the introduction of Government regulations and a system of cultivation, yielded 203,279,000 oysters, of a value of £178,887.

" Mr. Brocchi states in his report that, while the number of 'parcs' in 1865 was 297, it rose to 4,259 in 1880. That, during this period, the number of oysters exported rose from 10,584,000 to 195,477,875.

" At Arcachon the rents ranged from 30 to 45 francs per hectare, according to the position of the 'parcs'; while in Brittany, 100 francs for an equal area is charged. Mr. Brocchi deprecates so high a tax upon the industry.

" In a report to the Minister of Marine and Colonies in France by Mr. Bouchon Brandley, Secretary of the College of France, relative to the generative and artificial fecundation of oysters, published, in the journal last referred to, on the 15th December, 1882, he says:

" The Marine administration has, since the creation of the ostricultural industry, never ceased to encourage by different measures, such as concessions, missions, &c.,

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every attempt having for its object the development and perfecting of this industry. It is to this, unquestionably, that ostriculture owes its present prosperity and the constant progress it has achieved—a progress which has been so brilliantly represented at the Exhibition of Bordeaux.'

"Mr. Bouchon Brandley, in another report (*Rapport au Ministre de la Marine relatif à l'ostréiculture sur le littoral de la Manche et de l'Océan, extrait du Journal Officiel des 22, 24, 25 et 26 janvier, 1887*) remarks on the progress of oyster culture in France : 'The strict observance of the decrees of 1852 in the conduct of the fisheries may be regarded as having contributed largely to the actual prosperity. These decrees, the wisdom and opportuneness of which the event has demonstrated, were intended to stop the spoliation and exhaustion of the oyster beds, and subject their exportation to strict and regular regulations.'

"The persevering application of these measures, the care unceasingly renewed, the encouragement and the example which the administration of the Marine continually gave, resulted in bringing about the restoration of the natural beds, which were approaching exhaustion, and in provoking a revival of oyster culture by private individuals.

"On this subject it might be well to quote such authority as Mr. Harding, who, in his paper on mussels and other mollusks used as bait and food, says :

"I consider the best and only way that existing natural mussel beds can be properly cultivated and protected is to make them the actual property of some one. If they are allowed to be fished indiscriminately they will quickly become exhausted, as has been the case with hundreds of natural scalps on the coast. Fifty years ago mussels were very prolific on the east coast of England, and almost every small harbour had its natural scalps outside, which fed the 'lays' or fattening grounds inside, to the great profit of the owners of such lays. About that period some ill-starred individual discovered that they were valuable for manure, when commenced a raid on the scalps, which is the origin of their present downfall. I can remember, as a boy, seeing hundreds and thousands of tons brought to land and sold to the farmers for manure at three-half pence a bushel.

"An Act was passed by Parliament, in 1868, called 'The Sea Fisheries Act, 1868,' which enables the Board of Trade to grant provisional orders to corporations and private individuals to regulate oyster and mussel fisheries ; but the result so far has been very unsatisfactory."

"Elsewhere he writes : 'The secret of the whole matter is, that where mussel and oyster cultivation has proved successful, the person undertaking the same has obtained a concession from the Government to work the beds exclusively himself, and has not been hampered by other persons claiming a right to fish on his grounds.'

"The oyster fisheries in Scotland, once so productive, have now dwindled down to a value of £1,000 a year, or a fraction of what they once yielded. There are scores of proprietors in Scotland—I can state from personal knowledge—willing and anxious to begin oyster culture, to restock exhausted oyster beds or to establish new ones ; but they decline to make the experiment and run the risk unless they are protected, as in the United States of America, where, for example, in the State of New York, the State sells to individuals an absolute right to foreshores and sea-bottom suitable for oyster culture, and guarantees, at the time, that this right will be protected by the State. It takes from three to four years to rear a marketable oyster ; and if during that period there is no security against a fleet of fishing boats swooping down and dredging out all the oysters, as has happened more than once, the proprietor would be a fool who would attempt oyster cultivation.

"Immediately after my visit to Loch Creran, Mr. Anderson addressed to me the following letter, dated 27th July, 1887, on the subject of the oyster and mussel fisheries on the west coast :—

"DEAR SIR.—With regard to our conversation of yesterday as to the cultivation of shell-fish on the west coast, I trust the Board will see proper to take action so as to protect this industry, without which protection it can never assume any important proportions.

"I had formerly occasion to address the Board as to the cockle beds of Barra, since which these valuable beds have followed the great mussel grounds of Loch Roag, and elsewhere, to comparative destruction. Every bed attacked will be treated in the same manner. So long as there is no control the people will continue to fish them out; while, at the same time, they would willingly have the beds protected against themselves were they equally protected against their neighbours.

"Besides the acts of depredators upon private beds, the industry at present requires to be protected."

Referring to the subject of Government cultivation, Mr. Young, from whom we have already quoted, says:

"Mr. McGibbon, Ivy House, ex-Provost of Stranraer, who has long been well acquainted with the oyster fisheries in Loch Ryan, and takes a great interest in them, recommends that the Fishery Board should select a suitable locality for the cultivation of oysters and mussels, that is to say, a locality not only physically suitable for the cultivation of the mollusks, but also capable of being easily watched and protected, and demonstrate to the fishermen the advantages of scientific cultivation of both as regards themselves and the general public."

The following memorandum by one of the inspectors of fisheries of the British Board of Trade (Mr. C. E. Pryer) will be found of interest:—

"The inquiry made by the Canadian Minister of Marine and Fisheries appears to refer to the methods adopted in England and France for the selection, for the purpose of oyster cultivation, of areas on which oysters do not naturally exist. So far as England is concerned, the efforts to develop the oyster fisheries has been almost entirely, if not altogether, limited to the maintenance of the supply from actually productive beds, and to the resuscitation of natural beds whose productiveness has deteriorated. Little or nothing has, as yet, been done in this country in the way of attempting to create new oyster beds by stocking grounds not previously known to have produced oysters naturally, though small areas of ground artificially prepared are, in some cases, used as places for the growth, or for the simple storage of oysters dredged from the natural beds, in contiguity to which such areas are usually located. In the majority of cases these areas are private property, and the steps taken are entirely at the discretion and risk of the proprietors or promoters. In cases where application is made for an order giving private rights over grounds on which there is a public right of fishery, it is usual for an inspector to make an examination of the ground by dredging, and to satisfy himself that the conditions are such that there is a reasonable prospect of oyster culture proving successful, and that the probable advantages are not so problematical as to render it undesirable to interfere with the public right of fishing for other fish.

"The conditions suitable for oyster culture vary, of course, in different localities and with different classes of oysters, but the general requirements may be said to be a suitable soil, consisting preferably of a bed of shells superimposed on hard mud or clay, an absence of sand, and of five fingers, dogwhelks, crabs and other enemies of the oyster, a tidal flow, and a certain admixture of fresh water, varying according as the bed is required for breeding purposes, or mainly as a fattening ground. In some cases oysters grow abundantly on rocky ground, and it is impossible to say generally, without a full knowledge of the circumstances of each case, how far any particular area may or may not be or become a likely oyster ground.

"A further consideration, which must not be omitted is, the difference between the ordinary American oyster and the European oyster.

"As regards France, I believe the above remarks apply generally. Oyster culture is carried on in that country to a far greater extent than in England, but I am not aware of any French beds artificially constructed or improved which are not on the site of or closely contiguous to grounds originally producing oysters without artificial help.

"At Arcachon, for example, where the most important of French artificial oyster fisheries are situated, the greater part of an extensive land-locked bay, portions of which originally contained natural oyster beds, has been converted into an oyster farm. The mud lands, foreshore and shallows are parcelled out into small areas allotted to different

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proprietors and concessionaries, and the flow and reflux of the tide are regulated by means of low embankments and sluices. In this way the water can be retained over ground which would otherwise be too long exposed during the ebb, or it can be excluded when necessary for such purposes as the preparation of the 'collectors' for the spat, the removal of spat, the sorting of oysters, &c. The supply of suitable soil is limited, but in many cases, by its skilful utilization, it has been spread over areas otherwise unsuited for the purpose of oyster culture.

"In Holland, also, where in some respects oyster culture is carried to a higher degree of development even than in France, and the area of many oyster beds has been extended over spots on which, without such artificial preparation, oysters could not possibly have grown, the natural beds have formed the nucleus of the 'artificial' grounds.

"A notable instance may be found near Bergen-op-Zoom, where the construction of a railway embankment converted one of the mouths of the Scheldt into a quasi bay almost land-locked, which has since been cultivated as an oyster farm, similar in general features to that at Arcachon, the flow of the tide being regulated by sluices. Oysters always existed over certain parts of the area, but by the construction of dykes, pits and channels, the area naturally available for the production of oysters is largely increased.

"It is not to be inferred that ground on or near which oysters have never existed may not possibly be converted into an oyster bed, but the probabilities are in favour of spots whose natural adaptability is shown by the presence or former existence of oysters."

From Deputy Minister's report, 1891, page xxiv.

"OYSTERS.

"Last year's report contained a very full article on the measures which it was proposed to adopt for the preservation and improvement of this valuable industry, and included a résumé of regulations for the formation and cultivation, under proper restrictions, of oyster beds. Since then, considerable progress has been made in this direction, and a system of reserving areas for the restoration of public beds, and licensing limited sections of ground to private applicants, for the purpose of encouraging natural and artificial cultivation, is now in full operation.

"At a conference of the fishery inspectors, held at Ottawa during the month of April, 1891, the existing state of the oyster fishing industry of the Dominion, and the best means of securing its expansion and improvement, was fully discussed, with the result that the following recommendations were made:—

"(1.) That no fee be charged for licenses.

"(2.) No one shall fish for, catch, or have in possession, any oysters the product of the Dominion of Canada, between the 1st day of May and the 30th day of September in each year, both days inclusive, and that in all partially depleted beds no fishing in the winter season through the ice be allowed; the several inspectors to furnish the department with a list of such beds, and the department to make the necessary regulations for such prohibition.

"(3.) No one shall fish for, catch, or possess any 'round' oysters under 2 inches in diameter of shell, nor 'long' oysters under 3 inches of outer shell. All oysters taken under these dimensions to be immediately restored to the water, under penalty of fine and forfeiture of all materials, implements, or appliances used, and the cancellation of the license.

"(4.) That all productive oyster beds now in existence in the waters of Canada be divided with as little delay as possible into three sections, which sections shall only be fished alternately, one section in each year, under the control of the local fishery officers, upon some general plan prepared by the department.

"(5.) The committee recommend that the department take the necessary measures to restock as many of the exhausted beds as possible, and that leases or licenses for a term of years be granted to parties willing to cultivate oysters, where no productive beds now exist, upon such conditions as the department may deem best.

"(6.) Also, that mud digging be prohibited within 200 yards of any live oyster bed; then only at such place, or places, as may be prescribed by a fishery officer.

"APPEAL TO THE PUBLIC.

"It is a well known fact that a great many localities in the maritime provinces which were, at one time, noted for the quality of their oysters, as well as for the fertility of the beds from which these molluscs were taken, have of late years become greatly depleted, and in some cases quite exhausted, owing chiefly to reckless and inordinate modes of fishing and the utter absence of any artificial aid in the propagation of the species, or care in the protection and cultivation of the grounds to which they were indigenous.

"Finding, from inquiry, that considerable satisfaction was manifested among residents of localities where exhausted oyster beds were to be found at the action taken by the department, and that a general appreciation existed as to the necessity of closing them against fishing for a number of years, for the purpose of giving them time to recuperate, the following form of petition was circulated in order to strengthen the hands of the department:—

"To His Excellency

"The Right Honourable Sir FREDERICK ARTHUR STANLEY, &c., &c.,
"Governor General of Canada.

"Your petitioners, having learned that Parliament has made an appropriation to meet the expenses in connection with the survey of oyster beds, begs to set forth:

"There once existed in this locality, viz., extensive oyster beds, the working of which not only furnished employment to many, but also proved an export of considerable value, but from overfishing and other causes the yield of the beds referred to has, for some years past, been falling off, till at the present time they are, if not wholly so, to a large extent unproductive.

"Your petitioners believe that the restocking of these beds can be successfully accomplished, and that under restrictive regulations the productiveness of the oyster fishery may within a few years be restored.

"Your petitioners would further state that in the event of any of the oyster areas in their respective localities being selected for the operations of the department, they would approve of all oyster fishing in such localities being prohibited for a term of years.

"Your petitioners would further desire that upon the expiry of the term of years for which, under the provisions of the Fisheries Act, beds may be set apart for the purposes of culture, that the raking or fishing of the product of these beds should be permitted only under judicious and restrictive regulations necessary for their enforcement and preservation.

"Your petitioners therefore humbly pray that the locality of surveyed and set apart with the above object in view." may be

"ANSWERS.

"In response to this appeal, petitions were received praying for the setting apart, survey and restocking of the following waters:—

"Shediac Harbour, Bale Verte and Tidnish, in the province of New Brunswick.

"Eastern Harbour, Cheticamp; Fader's Pond, on the south side of St. Ann's Bay; Sydney River, Lingan Bay, Mira Bay, Catalone Bay, East Bay, and Big Glace Bay, in the province of Nova Scotia.

"Summerside Harbour, Orwell Bay, Enmore West, and Winter Rivers, in the province of Prince Edward Island.

"ACTION.

"An appropriation of \$5,000 having been voted by Parliament during the past session for the survey of oyster beds, and for the purpose of assisting in the planting and formation of new ones, Mr. Robert Simpson, C.E., was instructed to survey Shediac Harbour,

which was formerly held in high repute for the excellent quality of its oysters, but whose beds, owing to excessive and improvident raking, had become practically extinct. A Minute of Council, based upon such survey, was adopted on the 1st September, 1891, setting apart about 270 acres of water area in the above-named locality, for the purpose of carrying on natural and artificial reproduction of oysters, and authorizing the Minister of Marine and Fisheries to incur the necessary expenditure in connection with such operations.

"It was fully expected that these operations could have been inaugurated during the same fall; but so much difficulty has been experienced in securing the services of a reliable expert that the experiments had to be postponed until the spring of 1892. This unavoidable delay may, after all, prove beneficial. While several authorities—especially European—contend that the fall is the proper time for planting, many others—and especially Americans—favour the spring months, as allowing time for the young oysters to grow large enough to be able to protect themselves and withstand our rigorous winter climate. Inquiries are being made through the High Commissioner for Canada in London, and Mr. Fabre, in Paris, for the purpose of securing the services of an expert with the view of his taking charge of operations next spring. When the services of a proper person have been secured, the department will be prepared to carry on operations in a systematic and, it is hoped, successful manner.

"A report on the Tidnish and Baie Verte oyster beds shows that the grounds are very much exhausted, and that very little fishing is carried on there at present. This depletion is, however, ascribed to natural causes rather than to overfishing—the water being shallow, the accumulation of old shells, and the ice which forms over the beds, is said to have the effect of killing the young oysters. This seems very plausible, but the real facts can only be determined by means of a careful inspection of the bottoms, which it is intended to have made in the spring of 1892 by one of the officers of the fisheries protection cruisers. A careful examination of the grounds will enable the department to determine whether their condition is such as to warrant the expenditure necessary to survey and restock them.

"In Nova Scotia."

"Sufficient information is not yet available to admit of any definite action being taken in the direction of the petitions received from various localities in this province, asking for the reservation and planting of oyster beds; but it is expected, if matters progress favourably, that it will be possible to begin operations at these points during the coming season.

"In Prince Edward Island."

"Summerside Harbour, once famous for the excellence of its oysters, has greatly deteriorated of late years. It is represented as exceedingly well adapted for the purposes of oyster culture, and with this end in view, arrangements have been made for a survey of the grounds and the setting apart of certain areas when operations are begun in the spring.

"Petitions have been received from various other localities in the above-named province, praying that certain exhausted beds be reserved for artificial culture, but sufficient information has not yet been received to enable the department to take definite action, although it may be possible to begin work on some of them during the coming season.

"OYSTER PLANTING."

"In restocking exhausted beds, it is intended that none but the largest and most carefully selected oysters from Prince Edward Island shall be used, and these will be planted only after careful examination of the bottoms and the removal of deposits of mud, rubbish or débris, likely to interfere with their growth. As these operations will be conducted under the supervision of an expert, whose services the department expects soon to obtain, there seems to be no reason to doubt but that our efforts will meet with that success which has attended similar ventures on the great natural oyster farms of

the Chesapeake and other localities in the United States. There, an immense area of waters, which either through improvidence or neglect had hitherto been sterile and worthless, has assumed a condition of natural fecundity and great value; and there is indeed no reason why similar results should not attend our efforts, if proper means and care be adopted.

"ADVANTAGES OF CULTIVATION."

"Very little attention has hitherto been paid to the improvement or cultivation of oysters by individuals or private companies in Canada. This has been due, not so much to a lack of enterprise on the part of our people, as to the absence of any regular system of leasing or licensing grounds, whereby parties engaging in such undertakings would be secured in the enjoyment of the fruits of their labour, and guaranteed against intrusion by unscrupulous neighbours, who, considering such work common property, would reap the benefits of their industry. This, of course, acted as a great drawback upon oyster culture by private individuals, and the time-honoured practice of fishing everywhere, and anywhere, at one's own free will, has prevailed. All the department has done was to see that the inadequate close season was strictly enforced.

"The marvellous success which has crowned oyster farming, and private culture especially, in France, England and Holland, has attracted the attention of Canadians, and they begin to realize the advantage of protecting and fostering an industry which, through private care and attention, has been found in the old world to repay handsomely for the labour, attention and outlay bestowed upon it.

"LICENSING OF OYSTER GROUNDS."

The applicants for oyster areas are required to make their applications on printed forms supplied by the department, the same being accompanied by a plan of survey made by a qualified surveyor on the basis of the admiralty charts. When these requirements have been complied with, the application is referred to the local inspector of fisheries for inquiry and report, and upon such report the department decides whether it is advisable to issue the license or not.

"The industry being in its infancy in our country, it was deemed unwise to hamper it with any but a nominal license fee. In Europe, the rental of oyster farms rules high, as much as \$19 or \$20 per acre being paid in Holland, while in France it ranges from 35 to 45 francs per hectare, and as high as the equivalent of \$7.60 an acre on the coasts of Brittany. In England, where the rights of fishery go with the ownership of the land, the practice appears to be to form powerful companies with a large capital, and acquire extensive areas at purchase price in the most desirable localities. In the various States of the American Union much diversity of rentals exists. California disposes of her oyster grounds to the highest bidder, and gives a title in perpetuity. The nominal price was at first \$1.25 per acre, but the demand for choice limits—in San Francisco Bay, for instance—became so great that as much as \$100 per acre has been paid for certain areas. New Jersey sells its oyster grounds to the highest bidder every five years, but limits individuals to ten acres each, and companies to thirty acres. In Georgia a fee of \$1 per acre, charged upon all grounds leased for oyster culture, is appropriated to the support of public schools. Rhode Island leases its oyster areas at \$10 per acre. In Chesapeake Bay—the oyster fishing waters of America *par excellence*—one of the very best grounds, called 'The Beach,' rents for from 2 to 5 cents per bushel of output, according to location. In the State of New York no uniform system of rental exists, the control by the fisheries being vested in different corporations and municipalities. Rates vary from 25 cents to \$10 an acre, although the greatest portion of the rents appear to be about \$1 per acre. No one person or firm can hold more than 250 acres, and in certain localities lessees are restricted to three or four acres.

"After a careful consideration of the above facts in connection with the licensing of oyster grounds in Canada, it was decided:

"1. To fix the fee at \$1 per acre calculated upon the acreage at low water, as shown on the approved plan of survey.

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" To fix the maximum limit of areas.

" The above system is now in full operation, and during the present year licenses have been granted to the following parties, who have already entered upon the work of planting and cultivating the grounds licensed to them:—

" Messrs. D. Hatton & Co., Montreal, 81 acres near Bay du Vin River, county Northumberland, N.B., licensed for fifteen years.

" Mr. Joseph Hayley, Ruskin, 2 acres in Pownal Bay, Queen's county, P.E.I., licensed for nine years.

" Mr. Charles A. Hyndman, Charlottetown, P.E.I., 40 acres, in North River and Ellen's Creek, Queen's County, P.E.I., licensed for nine years.

" Several other applications from Nova Scotia, Prince Edward Island, New Brunswick and British Columbia are under consideration; and it is expected that the work of protecting and re-stocking our oyster beds, which has so propitiously begun, and which appears to be so favourably looked upon by an intelligent public, will be greatly expanded, and ultimately achieve the end which this department has in view—that is to say, placing the oyster industry of Canada upon a firm and stable basis of prosperity, so as to provide an additional source of wealth to our country, and particularly to our maritime population.

" Final recommendations in detail:

" (1.) That no fees be charged for licenses.

" (2.) The close time to be established between 1st May and 30th September, both days inclusive, and that in all partially depleted beds, no fishing in the winter through the ice be allowed.

" (3.) Oysters 'round' under two inches in diameter, and 'long' under three inches of outer shell shall not be taken.

" (4.) All productive oyster beds to be divided into sections and to be fished alternately.

" (5.) The department to take the necessary measures to restock exhausted beds, and leases and licenses to be granted to parties willing to undertake oyster cultivation.

" (6.) Mud digging to be prohibited within 200 yards of any live oyster bed, and permitted only at such places as are prescribed by a fishery officer.

The oyster fishery has been partially brought under the license system. The close season is now from 1st June to 15th September. Fishing through the ice is no longer allowed. However desirable a minimum size may be, it would be difficult and expensive to enforce such a regulation. The department intends restocking exhausted beds, and encourages operations of the same nature when undertaken by private parties. The regulations provide for the digging of mussel mud.

From report of the Deputy Minister, 1892, page xv.:

" Previous reports from this department relate the measures adopted, and the work done to promote and preserve the oyster fishery. These reports show that if the oyster fishery is to be saved from extinction, efficient measures would have to be adopted looking to less destructive modes of carrying it on. The reasons for this depleted state of the oyster fishery are so fully set forth in these reports, that it is unnecessary to recur to them again here.

" In 1885, the close season was extended by fifteen days, making it read from 1st June to 15th September, in each year. This was the only regulation bearing upon the oyster fishery of the Dominion, and it was manifestly inadequate to ensure necessary protection to such a valuable industry. The fishery has been, and could still be, relentlessly pursued by persons seeing fit to take oysters at any place and in any manner they pleased, wholly regardless of the size taken and the injury done to the beds by leaving a quantity of small oyster shells and mud on the ice to drop on them in the spring of the year. These facts were brought to the Government's attention by the Minister of Marine and Fisheries in a report dated 1st March, 1890, and a Minute of Council was subsequently adopted recommending the following measures:—

" 1. No oyster fishing to be allowed, except under leases or licenses from the Department of Marine and Fisheries.

" 2. The close season to be from 1st June to 15th September.

" 3. No oysters less than two inches broad or less than three inches in length, to be taken.

" 4. Dipping for mussel mud to be prohibited within a distance of 200 feet from any live oyster bed, and then only at such places as may be prescribed by a fishery officer.

" 5. The above regulations not to take effect till surveys of the oyster beds are made. In order to facilitate the applications of persons desirous of obtaining licenses for the cultivation of oyster beds, regulations were adopted to guide surveyors in preparing plans and descriptions for application for oyster fishery licenses. These are supplied to all applicants free of charge. It was at the same time decided that the licensing of the grounds would be made on the following basis :—

" 1. License fee, \$1 per acre, calculated upon the draft at low water, as shown on the approved plan of survey.

" 2. A maximum limit of areas.

" Inspection in New Brunswick.

" After some correspondence with oyster experts in England and France, the Messrs. Frederic and Ernest Kemp, who had had considerable experience in connection with the Whitstable Oyster Company (the largest and most important and influential corporation of the kind in Great Britain), were engaged to come to Canada and make a preliminary inspection of oyster beds. These gentlemen sailed on the 24th May, reaching Halifax on the 5th June following. They immediately proceeded to Shediac Harbour and began examining the beds there. A careful inspection of the whole of Shediac Bay convinced them that it would be a suitable place for natural oyster culture. They found the beds in a most deplorable condition through neglect, want of proper care and attention and the ruthless manner in which the mussel mud diggers had cut them all to pieces, leaving a lot of disjointed patches, with an immense accumulation of soft mud around the beds. It was four days before they could meet with a piece of ground large enough to cultivate oysters upon. The best area was found abreast of Mr. Harrington's house ; it could be very much enlarged by using proper means, there being good ground all round, and a sufficient depth of water. Other beds were also found which can be connected by time, care and labour. The northern portion of the bay was found to be entirely useless for oyster culture, the bottom consisting of long grass and very soft mud, so much so that the grounds known as the Poirier beds are nearly silted up. To make them successful, the Shediac beds must be entirely and thoroughly cleaned by dredges, such as are employed on the oyster beds in England. The rake at present used in Canada should be discarded. It is very destructive to the oyster brood and grounds. There would be no advantage in planting oysters upon such beds in such a dirty state, during the summer season ; but with proper care and attention the experts do not see why these grounds could not be made to yield a never-failing source of supply, as their situation is so well adapted for oyster culture. They conclude by recommending that the limits set apart by Order in Council for the natural and artificial propagation of oysters in Shediac Harbour be changed, the northern portion thereof being of no value whatever for the above purpose. This recommendation has been carried out.

" From Shediac the Messrs. Kemp went to Buctouche, where they found the whole of the oyster beds, with the exception of the Dixon bed, a mass of disjointed patches, caused by mussel mud digging. Up the river, beyond the railway bridge, the beds were in the same condition. The patches generally showed a very healthy condition, with the exception of those where fishermen had been in the habit of raking oysters through the ice. No grounds could be found having sufficient depth of water to warrant the cultivation of oysters in the river and bay. The bed off Dixon's Point was in a dirty condition, showing by the appearance of the soil that it had been long disused. Seven hauls were brought up, yielding eight very large, healthy oysters, and a dredge full of old shells. To clear this ground would prove a matter of very little labour, and oyster brood would thrive therein. In the bay and river, above and below the railway bridge, patches of ground were found teeming with live oyster brood, growing very fast and plentiful. A much greater proportion of oyster brood was found than the full-grown oysters ; one

haul brought 10 oysters and 54 brood, another 40 brood and no oysters, and several hauls in like proportion.

"Cocagne Harbour was found to be in about the same condition as Buctouche; oyster brood being much more plentiful than the full-grown oyster. No ground was found available for planting during the short visit of the experts.

"At Richibucto, the experts report things in the same condition as in the two above-named places, with the addition of a much larger quantity of oyster brood over every patch of ground dredged. This brood was abundant and in the healthiest condition. No mortality whatever was noticed; everything brought up by the dredge proved to be oyster brood. The patches were small, owing to the operations of the mussel mud diggers, the surroundings being composed of eel grass and soft mud. Were it possible to form ground sufficiently hard to receive the spat, there could, from Bay Cove to Kingston Bridge, be saved a sufficient quantity of oyster brood to supply the whole of England's oyster beds. On every small patch dredged, the hauls of oyster brood were as follows:—163, 105, 195 and 108. Coming to a more extensive patch, the experts were able to get a larger quantity. One haul brought 811, the greatest portion of which consisted of undersized oysters. The oysters above Kingston Bridge are said to be inferior in quality, but there is reason to believe that if oyster brood were transplanted young on other beds suitable for oysters, they would develop into good marketable oysters. Very few oysters were found in the N. W. River; the grounds appeared to be very old, the mussel mud diggers having cut the beds all to pieces. The only ground found suitable for planting oysters on was between Indian Island and the mainland. Some portion of this was comparatively clean, but the greatest part would require to be cleaned before it could be planted, there being a substantial bottom.

"Throughout the whole of their inspection the experts report that they did not find a single marine enemy to the oyster, which is in itself a remarkable fact. The cause of the depletion of beds can, however, be accounted for in many ways; destruction going on at a wholesale rate. On the arrival of the experts at Cocagne, there were found as many as twelve boats with men in them raking for oysters during the close season. Three of these were seized, but the others managed to escape. While steaming up Buctouche Harbour, a number of boats were noticed raking; the men flew in all directions, leaving their rakes in the water.

"Another cause of destruction is the fishing for oysters through the ice. While dredging, the experts came upon a piece of ground consisting of a high bank. When the dredge was hauled, it was found that instead of life and growth as before, the whole contents of the dredge consisted of bleached shells, with no signs of life on them. There had been brood, but it was dead, and this unmistakeably showed that something was wrong. Subsequent information elicited the fact that this was the result of raking through the ice. Consequently, all brood exposed at such a time of the year means inevitable destruction; also, when the ice thaws, down goes the refuse, making a high bank. The mussel mud digger entirely destroys the oyster beds wherever it is worked. The ground simply becomes irrecoverable; consequently, the Canadian oyster beds are becoming more contracted every year. Oysters are, moreover, taken all the year round, regardless of size or close season.

Inspection in Prince Edward Island.

From New Brunswick, the Messrs. Kemp went to Prince Edward Island, on the 30th July, beginning their work by an examination of the oyster beds in Bedeque Bay. They report that the greater portion of this bay consists of mud and long grass, and that nearly the whole of the beds are entirely destroyed by mussel mud diggers. Off Oyster Point, there is a portion of ground where the bottom is hard, but the grass and weeds are so thick that it is impossible to know what the soil is like. Apart from this, there appears to be only one available spot for the cultivation of oysters, situated off the north shore towards Wilmett's Cove. Some part of this ground was found to be clean, but the greater portion was covered with weeds and short grass. The bottom was firm, the oysters brought up were of very fine quality; three hauls yielded 22 oysters and 84 brood in a very healthy condition, the brood showing rapid growth. The grass could,

with very little labour, be cleared, and the grounds made suitable for planting. This portion of the bay would be safe against mud diggers, as they cannot find sufficient depth of shells to answer their purpose. These grounds were staked off.

Richmond Bay was found to be nothing short of a gold mine. Some of the beds are extensive, comprising several acres, and the stock compares well with that of cultivated grounds. Its resources appear to be enormous, the beds being well stocked with oysters and brood, which was found to be of good quality and in healthy condition, making a rapid growth. In every part explored, where soil could be found, there were oysters and oyster brood. In no single instance were death or a marine enemy to the oyster met with, a most remarkable coincidence over such a large area of ground. A great number of hauls were made over different parts of the bay. Dead weeds and mud were only noted from Oyster Cove, including Indian River, to Rayner's Creek. The experts were informed that they would not find any beds there, as they had all been cut to pieces by mussel mud diggers, although at one time these were the best in the bay, as the fishermen could always work upon them on account of their being sheltered from strong winds. There were at least four miles of the beds destroyed. Several hauls were made off Mill's Point, McNeill's, Lock Shore, River Platt, Fraser's Cove, Narrows, Lot 12, Squirrel Creek, Niggers Point, Joe Benward's Point, Sally Francis, Cooper's, Bideford River, Schooner's Creek, Barclay's Creek, Front River, Bird Island and Enmore River with successful results. From the Bar to Bryant's Point, nothing but weeds and mud were found, although it is stated that originally the bed was half a mile in length, but it has been completely destroyed by mussel mud diggers.

The experts conclude their report of inspection in Prince Edward Island by remarking that every oyster taken up by a fisherman is brought ashore, regardless of size. These are sold to merchants, who select the marketable ones, and the undersized oysters are thrown away as refuse. Such a disastrous system, they claim, should be put a stop to, and no oysters under the size of three inches allowed to be taken. By this means next year's stock would be saved and the beds preserved. From Richmond Bay the experts proceeded to Charlottetown, and inspected North River, West River, Vernon River and East River. In North River they saw very little soil or oyster ground, but were informed there were oysters above the bridge, where they could not go up with the steam launch. In West River, at Long Creek, abundance of oyster brood in a healthy condition was noticed, growing very fast; the beds extending nearly half a mile in length. In Vernon River three hauls of the dredge brought up 30 oysters and 614 brood. The experts were informed that Orwell Cove and the grounds in Orwell Bay would compare favourably with those already dredged in Vernon River. In East River the beds were completely covered with oyster brood of very fine shape and form, different from the oysters found in other beds in this part of the island. It was stated that a continuation of this brood could be found at every point from 10 to 15 miles along the river. The experts consider that persons who have leased oyster grounds for oyster culture would do well to use this brood to restock them. As a rule, oyster brood picked upon an ebb-dry ground are much harder than those taken from deep water; and by removing them into deep water they would be secure from the heavy frosts which prevail in Canada. The quality of some of these oysters is quite as good as those of Richmond Bay, many of them being long-shaped. No long oyster should be fished for market under four inches in length.

"Taking everything into consideration, the experts consider there is no danger of Canadian oyster beds becoming depleted if the laws of nature are observed, and the recommendations which they make carried out.

"On completion of their labour in Prince Edward Island, it being found that the presence of Mr. Frederic Kemp was no longer required, he was permitted to return to England on the 10th September, and Mr. Ernest Kemp was subsequently engaged for a period of three years to continue the work. He was then directed to prepare the grounds in Shediac Harbour so as to make them fit for planting, which he did by removing the refuse and culch from the grounds and placing it alongside to fill up soft holes around the beds; the oysters and brood which are caught being placed on other beds not yet touched. He will be engaged at this work until the freezing of the harbour compels him to give it up.

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"In addition to the above, Mr. Kemp was directed to inspect Tracadie Harbour, in Antigonish County, N.S., and select areas for the purpose of restocking oyster beds in the above-named waters."

From Deputy Minister's report, 1893, page xlvi. :

THE OYSTER FISHERY.

In the spring of 1893 Mr. Ernest Kemp continued the preparation of the Shediac grounds. The cultch and shells which had accumulated on these beds were removed from the top and placed on the mud, on the outside edges, or in some of the holes caused by the mud diggers. The ground was cleaned on the edges, the beds were made much larger, and the soil made ready for restocking with oyster brood. Owing to some delay in procuring the necessary oysters from Prince Edward Island, no planting was done during the fall of 1892. In view of the lateness of the season, the danger from frost, snow, and the change of water, Mr. Kemp deemed it more prudent to delay these operations till the following spring, which he considers the best time for planting, as the oysters will then grow much faster if placed in shallow water during the spring and summer months than if placed in deeper water, as the sun causes the water to become much warmer, the oyster being very sensitive to the action of light and heat, which promotes a rapid growth. Oysters planted in the autumn are not likely to thrive as, owing to the change of soil and falling temperature, the oyster is not properly acclimated before winter sets in, which very often proves disastrous. Oysters grow but very little during the winter months, consequently it is all risk and loss, with no gain, although there are exceptions in every case."

It is not necessary for me to deal with this subject much further, as it can be clearly seen what strain and abuse this industry has been subject to in the maritime provinces, which are fully mentioned in former pages, consisting of mud digging, reckless and indiscriminate fishing, irrespective of size or season, winter fishing, saw-dust thrown in rivers, which cover the beds, ordinary fishing, overfishing, and various other methods have been used, which have only been detrimental to the industry, nature having to contend against all the above obstacles with really no practical assistance from man; but it is to be hoped that fishermen will see the necessity of adhering to the regulations which have been framed in order to assist the recuperation of fished-out areas. Since I have been connected with this department, my time has been wholly taken up with this branch of the industry. I have visited nearly all the principal oyster areas in the maritime provinces; have also cleaned and planted areas as experiments, which have thus far proved successful.

It was not long before the main facts were discovered which have caused the depletion of so many of the oyster beds, and the department have since been engaged in trying to subdue some of the existing evils.

The oyster industry is rapidly passing from the hands of the fishermen into those of the oyster culturist. The oyster being sedentary, except for a few days in the earliest stages of its existence, is easily exterminated in any given locality; since, although it may not be possible for the fishermen to rake up from the bottom every individual, wholesale methods of capture soon result in covering up or otherwise destroying the oyster banks or reefs, as the communities of oysters are technically termed.

The main difference between the oyster industry of America and that of Europe lies in the fact that in Europe the native beds have long since been practically destroyed, perhaps not more than 6 or 7 per cent of the oysters of Europe passing from the native beds directly into the hands of the consumer. It is probable that 60 to 75 per cent are reared from the spat in artificial parks, the remainder having been laid down for a time to increase in size and flavour in shoal water along the coasts. In the United States, on the other hand, about 40 per cent are carried from the native beds directly to market. The oyster fishery is everywhere (except in localities where the natural beds are nearly exhausted) carried on in the most reckless manner, and in all directions oyster grounds are becoming deteriorated, and in some cases have been entirely destroyed. It remains to be seen whether the Government will regulate the oyster fishery before it is too late, or will permit the destruction of these most important reservoirs of food. At present the

oyster is one of the cheapest articles of diet in the United States ; and, though it can hardly be expected that the price of American oysters will always remain so low, still, taking into consideration the great wealth of the natural beds along the entire Atlantic coast, it seems certain that a moderate amount of protection will keep the price of seed oysters far below European rates, and that the immense stretches of submerged lands especially suited for oyster planting may be utilized and made to produce an abundant harvest at much less cost than that which accompanies the complicated system of culture in vogue in France and Holland.

I will now give a brief description of the cultivation of oysters as it is carried on, under their different headings.

OYSTER CULTURE IN ENGLAND.

THE WHITSTABLE OYSTER COMPANY.

My idea is to try and convey to the mind of the culturist, certain things to be carried out, and others to be avoided in order to make his labours a success. By giving an outline of practical work carried on abroad, it will then show by what ways and means it can be done here, always bearing in mind the difference of temperature which exists in other waters read about, and the grounds which are proposed to be cultivated in this country.

" My intimate connection with the Whitstable Oyster Company, of which I am a member, and where I have gained most of my practical knowledge and experience, will enable me to bring to your notice a few facts connected with the inception, the development and the present standing of the above-named concern.

The exact date of the formation of this company is not known, oysters having been found on these shores from time immemorial ; a record of the members who owned the above company is to be seen in the museum at Whitstable, dated about 1660, consisting of about twenty members. This ground as an oyster fishery they found to be very valuable, but labour being very scarce at the time, these members allowed the labouring men to take an equal proportion of the dividend, and finally allowed them to remain as members.

In 1793, an Act of Parliament was obtained, incorporating the company of Free Fishers and Dredgers of Whitstable, and granting them the Common Seal. Since that year, the company has regularly held each July its water court, presided over by a steward. On that day all its officers are elected for the following year. Only freemen are allowed to attend meetings, or fish on these grounds, a rule rigidly enforced.

The membership of this company was originally obtained by birthright, only the sons of freemen were admitted on the annual water court following their twenty-first birthday, but owing to the numbers becoming so numerous, it was decided to take only the oldest sons ; finding this course did improve matters in the company, they have last year (1806) formed themselves into a joint stock company, valuing each member's share at so much per head ; now a person can sell his whole share, or a portion of it to any one who chooses to buy. The company working strictly on a commercial basis.

The oyster beds are about one and a half square miles in size, but the company hold land and freehold to a great extent.

From two to three hundred men find employment in the oyster fishery nearly the whole of the year. The total number of members at the present time belonging to the company is 550, the annual turnover being about £70,000, and the total value of the whole concern is estimated at about £200,000 sterling.

Their grounds are always kept well supplied with stock, consisting of marketable and young oysters, which are either bred on their own grounds or purchased from the surrounding oyster grounds adjoining them.

A great deal of the labourers' time is taken up on the grounds at Whitstable in keeping the area clean and in order ; this is done with more than one motive in view. I must here explain that several classes or qualities of oysters are planted on these grounds, and the area is divided, by stakes, beacons and buoys into square patches, keeping each grade of oyster on its own particular bed.

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The workmen receive their instructions from one of the junior officers of the company (having previously received them from the working committee or jury as they are called) commonly known as the "bellman"; he is really a messenger, but when these men are required at an early hour in the morning, they are informed on the previous evening, that the bell will, or will not, be rung the following morning a little earlier than the time named to commence work, to enable the dredgermen to be ready on time.

These men are instructed how long to work; the area they are to work upon, and the quantity of marketable oysters they are to bring on shore; they then leave for the grounds which are from three to four miles distant off shore, the time being set on their arrival on the oyster beds by one of the officers; it is a very pretty sight to see a fleet of sailing sloops and cutters lying idly at their moorings, with everything quiet; but at the cry of "the orders are out," every one being on the alert, there is an instantaneous move made, and all is life and bustle, the row-boats leave the shore with from four to seven men as a crew for each boat, these boats have from a quarter to three quarters of a mile to row to the sailing (or dredging) boats; they use from three to five dredges (five being the limit), and their time on the oyster ground is occupied in culling out from the contents of the dredge all marketable oysters that are required for their day's catch or "stint," as it is called, the spat, young oysters, or half-wares are not overlooked, but are carefully picked out, and if attached to weed, stones or shells, are removed, if it can be done without injury to the young oyster; these are placed on an area especially reserved for them, the shells are then carefully gone through, and if any marine enemies to the oyster are found, such as starfish, dogwhelk, mussels or seaweed, they are placed on one side to be destroyed, the shells are then returned to the water, the dredge is again hauled to the surface and the above performance is repeated.

Sometimes a few boats are to be seen working on an area where the young ones are planted, these crews are generally selected as careful men; they go to examine the state of the ground, pick out all marketable oysters, and see there are no enemies to the young ones. Through the continual working of these grounds, the shells are kept very clean, they lie very thick upon the beds, and this is the only method that is used to try and catch the spat, as the area is so exposed to the open sea and to all the fiercest gales that blow, viz., from the north-west round north to about east-south-east, it is surprising what is annually found on these shells to an interesting observer. Not near enough, however, are saved to supply the demands of the trade, and young native oysters are bought from the fishermen who dredge on the natural grounds, also from oyster culturists in Essex, who are more successful in saving their spat, owing to the sheltered localities in which their beds are situated. These grounds at Whitstable are considered the finest on the coast for fattening purposes, and their name comes first among oyster culturists.

If the boats are working time or tide work, when the day's work is completed, a signal is given by either the foreman, or one of the men in charge of the fleet, to discontinue work; all the boats are then headed for their moorings; on reaching them the sails are furled, the oysters are placed in the row-boats, and every boat makes its way to the company's store with all possible speed, the master of each boat reporting to the officer in charge the number of oysters caught, also the number of men who worked with him. The oysters are received by a staff of men who place the oysters in hoop-nets, which hold about two bushels (16 gallons) each.

Under cover of this store are two large pits with concrete bottom and sides and connected with the sea by a sluice pipe, which dries at half tide: this pit can be kept with fresh sea water or let run dry, as desired. The nets of oysters are attached to ropes and suspended in the pits until they are required for market, the time varying from immediate use to about forty-eight hours, when the stock is again replenished. It is in this way that the public are supplied.

Sometimes, through stormy weather, the stock on hand will get very low, and on such occasions a boat can always secure the number required, and are sometimes paid a little extra for their trouble. The oysters, as they are ordered for market, are raised from the pits, are re-culled, counted, or measured, and washed clean, which is a very important item in the English market, packed up in sealed boxes, or securely sewn up in strong bags; they are then hauled to the railway depot, where the facilities are good for the transit of perishable goods.

These beds lie in about 6 feet of water at low water time, there is a rise and fall of about 12 or 18 feet, ordinary spring tides.

The company is governed by officers elected each year, forming two committees, which work jointly and separately, one called the finance or estate's committee, which attends to the financial affairs, while the other is called the working committee, or "jury"; it is the duty of the latter to see that the ground is properly worked and cared for; they will lay off areas and superintend the laying and catching of oysters and other minor duties. A chairman is appointed in charge of the former, while a foreman and deputy foreman is attached to the latter, with treasurer, secretary and other minor officers.

Until about the year 1875 no French brood or oysters were laid on English oyster grounds, but owing to the scarcity of spat falling in English waters, on account of successive cold seasons, which has caused a steady decrease of oysters round the British coast, they owe to French oyster culture the success they have been so fortunate in obtaining large quantities of oysters by artificial means, where they are enjoying a milder climate, have crowned their labours with success, and are now enabled to furnish the English markets with whatever supplies that are needed. Larger quantities of oysters are imported from France each year, and before I left England the company alone laid on their grounds 20,000,000 of French oysters to enable them to supply the demands of the trade in the following season, with a good second quality oyster.

These oysters are laid every spring from the south of France on the oyster beds, which are excellent fattening grounds, supplying the public generally with a good cheap oyster, and it is found by practical experience that, commercially, it pays better to purchase an oyster two-thirds grown in the spring of each year than to expend the same amount on artificial experiments. The oysters are sometimes conveyed in large quantities by fast steamers direct from the French plantations, all on arrival are immediately laid on the grounds. As many as 5,000,000 oysters have been laid in the space of four hours. The dredging boats will run alongside the steamer and will take a deck-load of oysters, and then sail over the grounds, distributing them by means of shovels as they sail along. A large staff of men are usually employed when there is any quantity of oysters to be laid, so that no time is lost and the oysters placed on the beds as soon as possible. In the fall they are caught and marketed, giving employment to a number of the members of the company with a profitable margin. As no artificial means are used beyond shelling and keeping the grounds clean for the propagation of the oyster, large sums of money are required to secure the stock. The price of native brood, or half-ware, has gradually been on the increase. Here is an illustration, for instance. In the year 1860 the vessel of Mr. Kemp, sr., and a few others (called market boats, as they are larger than the ordinary dredging boats, and are engaged in conveying oysters from the different fisheries to market) were engaged in obtaining oysters for planting for the company; one of the cargoes consisted of 112 tubs of oysters (24 gallons to the tub), the price then paid was six shillings per tub, total value, £33 12s. On his return from Canada, after an inspection of the oyster beds in the maritime provinces, in 1862, or thirty-two years later, one of his vessels had on board a cargo of the same quantity and quality of oysters; the sum paid for them by the above company was £15 per tub, or a total value of £1,680, thus showing the care and interest taken to preserve so valuable an industry.

These areas are perfectly level and even; they are kept so by the means of dredges working over them, there is a good foundation of shells which serves as a bed for the oysters, they also act as spat collectors.

The company are most particular with their beds, great care being taken not to disturb or destroy the soil; a vessel is not allowed to anchor on the grounds, they being guarded by three watchboats with crews for night and day work; a rake of any description is not even allowed to be used, under any consideration, under a penalty of £10; and in the year 1887 a vessel named the "Resolute," of about 350 tons burthen, through an error in the captain's judgment, ran aground on the beds and remained there for eight hours; although this vessel was owned by members of the above company, yet the matter was compromised by payment of £150 for damages, instead of allowing the case to be settled

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by law, thus showing the value and the care that is bestowed on these beds. Other companies are just as particular in their care and preservation of their beds.

The company's "store" before referred to, is a spacious building, built at the head of the beach, and, besides containing the pits, the lower part of the building is divided into packing rooms, storerooms for boxes, bags, twine, and other necessary material and implements that are used, offices and committee rooms, and above this flat there is a large hall covering the whole building and capable of accommodating over six hundred persons; it is in this hall that all their meetings are held, being either annual, quarterly or special, and where all their general business is transacted, so that all the work of the company is carried on under one roof. From these offices one has a splendid view of the sea, including the oyster beds in the distance.

This work is carried on year after year by those connected with oyster grounds, much the same as a farmer who attends to his farm and crops, so that by his labour and exertion he is looking toward the future for favourable results.

This company carries on its business on a very large scale. It can, however, be seen how it is done; its methods are simple, great care is taken of the grounds and brood, the storage of oysters in small net bags suspended in the pits is only temporary, as the stock is replenished every day or every other day, as the case may be.

The English and French oysters are not so hardy as the Canadian oyster.

This work could be carried on in just the same way in this country, even on a small scale, and it could be made to pay, with profitable results.

The above company has recently been transformed into a limited company, allowing each member an equal share, and any member is now at liberty to sell his shares to anybody he pleases. I am pleased to state the price of the shares is continually rising, which speaks for itself. The work is still being carried on under a commercial basis, the labourer being paid for his hire, with a staff of experienced men acting as directors and general managers of the concern.

Very little, if any poaching is carried on by the outside fishermen in English waters. At one time some of the ordinary fishermen were strongly opposed to the scheme where companies applied for concessions, but after these companies became established in many cases it was found to be of great benefit to them, as it opened up a ready market for their catch of oysters, whether young or old, and often they would find employment by hiring themselves and their boats to the oyster growers, where their time would be taken up in cleaning and cultivating the grounds, also catching oysters for market when trade was brisk, so that the apparent loss of a small area of ground which was entirely useless to them, but where they would occasionally try to fish upon, eventually became a source of employment to many of them with regular wages.

Should any poachers be caught in the act they are severely dealt with at the hands of Justice, either by paying heavy fines or imprisonment. To prevent raids being made by poachers on these valuable grounds a staff of watchmen are always on hand for both day and night work. Dogs are often trained on these watch boats to bark as soon as a boat or vessel comes within the limits of the grounds, or is sailing by. These means all tend to keep marauders at bay. Creeps or grapnels are sometimes used; they are attached to chains and spread over the areas, which would catch a dredge if it were hauled over them. Prevention is often better than cure.

Dr. Bashford Dean, in a report on the European methods of oyster culture quotes the following:—

"Oyster culture in England generally varies but little in methods from that of Whitstable; other localities, therefore, need be but little commented upon. At Faversham, to the westward, and Herne Bay, to the eastward, of Whitstable, sediment deposit and invasions of mud, and, at the latter place, shifting of sand also, have been of considerable annoyance. The remedy has been continual dredging of the grounds, together with judicious shelling or macadamizing of the bottom at certain points. Weeds have been carefully dredged out as a means of keeping the ground clear and allowing the tides to wash off the depositing sediment. In regions where spat is expected to occur with some regularity, the greatest care is taken by reshelling and clearing the bottom, to assure the greatest chance of a successful set. This character of bottom is often secured in the

rivers Blackwater, Crouch and Colne (below Colchester) by a regular process of harrowing the bottom during the beginning of the spring. By this means, the loose sediment accumulating during the winter is broken up and carried off by the tide. For this operation a harrow is prepared whose teeth, two or three inches in length, are of iron, bent slightly forward at the tips. When in use it is carefully arranged so that the teeth may not break through the crust which was formed by the shelling process of former years; this is prevented by adjusting the length of the harrow rope from the dredging vessel, and the behaviour of the harrow, like that of a dredge, is readily determined by the 'feeling' of the rope."

ESSEX OYSTER GROUNDS AND AREAS.

On the northern side of the entrance to the River Thames the county of Essex is situated, with oyster breeding areas in the rivers Blackwater, Mersea, Colne and Crouch; these rivers contain very valuable oyster breeding areas, they are owned by companies and individuals, who cultivate their beds with extreme care, and protect them from molestation; their mode of dredging is somewhat similar to those of the Whitstable Company, with the exception that some of these grounds are worked by small steam-boats, built expressly for that purpose. Some of the rivers are winding and inland, with a comparatively strong current; they cannot depend on wind to assist them, and as these beds are worked nearly every day, it is considered more economical to use steam. These boats are built with a very wide beam, and the deck is carried out from the stern of the boat to the outside edge of the paddle box, giving a very large deck area on a small boat.

The owners of these grounds are very particular about the shelling of their beds, as this is the mode of catching their spat; the shells are exposed to the sun, wind and rain; they are dried in this way; all animal and vegetable matter dies and becomes separated from them, and on moving these shells they are very clean in appearance, rough to the touch, and are most suitable as spat collectors.

Cockle shells are also used as spat collectors in these rivers, the shells are small and light, not sufficiently large to alter the shape of the oyster in its growth; they are also easily detached or broken off from the young oyster. Large quantities of cockles are caught at Southend and boiled on the shore, the fish being extracted from them by means of a sieve, just in the same way as cinders are separated from ashes, the fish of the cockle being sent to market already shelled, or in bulk, as we term it, and is considered a delicacy by some; the shells, after being subjected to boiling water, are very clean, and serve the above purpose admirably.

With some companies, the shelling of their grounds just previous to the spatting season amounts to quite a considerable sum, the shell of the cockle, being very light, is laid down as a finishing touch to their work; they then let them rest during the summer, anticipating a spat of brood as a reward for their labours.

Cockle shells are also secured for shelling oyster beds from the shores of the Isle of Sheppy.

Oyster pits have been dug out along these rivers abreast of the oyster grounds, for the purpose of storing oysters for immediate shipment in large quantities, especially to the French and Belgian markets; the oysters are caught daily and deposited in the pits until a vessel arrives for the purpose of taking them across the North Sea; it was in this way that I became acquainted with their methods, having accompanied my father in one of his vessels engaged in the oyster trade, from the time when I was quite a boy, he having been connected with these merchants and the foreign market since 1859; afterwards taking charge of the work myself. These pits are extensive, and are connected with the river by a sluice, and can be drained dry in one tide if desired, as the bottoms of the pits are above low-water mark. Large quantities of oysters, in fact, nearly all their stock of small oysters, are wintered there on account of the freshets in the early spring, and if the weather is at all severe, the oysters are very much weakened by the frost, with the fresh water added, tends very much to kill them, and it is with this motive the oysters are pitted; this process also has a detrimental effect on the growth of the oyster, but saves its life, as, in the first place, the English native oyster is

process of harrowing loose sediment by the tide. For this length, are of iron, so that the teeth of former dredging y determined by

of slow growth, but when continually moved from the beds to the pits, and then transplanted back again, it has the effect of materially stunting its growth ; the shell is hard and clean, with a clear pearly inside.

At Brightlingsea, in the waters of Colne Creek, French Portuguese, North Sea and American oysters are laid down for fattening purposes along the ebb-dry, the tide recedes from high-water mark, leaving extensive flats dry, which are excellent fattening grounds. These areas are planted at, or just below, low-water mark, during the spring of the year, the owners watching them and occasionally moving them about to prevent them from being silted over ; also to pick out any enemies or dead ones, and, when ready for market, are easily obtained ; these oysters are disposed of, as a rule, before the frost sets in, which is very destructive to the oyster when it is lying between wind and water, or they are removed to the beds lying in the channel of the river.

At the mouth of the River Colne there is a large tract of water named Pont, with a very firm bottom, something similar to the Kentish flats, where public oyster dredging is carried on ; the oysters caught from such areas as these are generally sold to companies, who relay them on their own grounds. No size limit is in force in England, as the young oyster is valuable, and if caught is not destroyed, but is placed on private grounds, the fishermen being paid according to size and quality.

OYSTER CULTURE IN FRANCE.

Having given a general description of the way in which oysters are cultivated in England, it is perhaps unnecessary to deal with the French methods at any length, as the work is chiefly artificial, and I consider it cannot be carried on as successfully here as there. This is owing to the long severe winters which visit our shores. The ice in the spring keeps the water chilled, and the weather being very unsettled until the spring is advanced, so that the season is late before anything can be done, as it is carried out in France, which I will try to point out as clearly as possible.

The industry in France was practically destroyed by overfishing in the fifties, when the Government took a firm stand and prohibited fishing throughout all their waters. This led persons to think of other ways and means of obtaining oysters, as large numbers were imported for daily consumption. A series of experiments were tried by different persons which fortunately crowned their labours with success. Others, watching their proceedings, were induced to make a venture at this new branch of industry, which seemed to spring up like magic. They obtained water areas, which were leased for a certain period from the State. These areas chosen were in sheltered and secluded bays and rivers, the ground was cleared of all mud, weeds and other refuse, the areas were then covered with a coating of shingle, gravel or clean shells ; an order or permit was granted to obtain a small supply of oysters for breeding purposes from public beds, or they were purchased from other merchants, as the case might be. These oysters were then laid on the area so leased. During the spawning season, brushwood was arranged all around and over their plots of land, tiles were also used, which were coated with a solution of sand and lime, forming a rough coating of cement for oyster spat to adhere to ; they are then arranged in layers or in piles laid crossways ; these tiles are not flat, but long and rounded, so formed that the spat might adhere to both sides of it. After the spatting season was over, they were carefully inspected, and if the spat had adhered, the tiles were sometimes placed into deeper water until the following spring ; others would strip them late in the fall. Their mode was to remove the young oysters by means of a peculiar kind of knife or chisel, removing the cement at the same time, and, with practice, a large quantity are removed in the course of a day. The oysters being very tender, cannot stand much rough usage, they are then placed in wire or gauze trays for a short time ; they are nursed in this way for more than one reason. The oysters are carefully handled, removing all the cement that can be done without killing them ; they are then returned to the trays to protect them from the marine enemies, viz., sand, mud, starfish, dogwhelk, dogfish, &c., until they are sufficiently grown to be large enough to deposit them on the layings to grow into marketable oysters. The trays are slightly raised from the ground so that no silt may settle on the bottom as dirt of any

description at this period would be fatal to the young oyster. These trays are placed in shallow water, where the growth is rapid during the warm weather. On these areas, which lie on the foreshores, the culturists will build up low stone walls made watertight with a mixture of clay and straw, having an outlet so that the water may be retained or drained off at will, at low-water time; If the weather is hot, the water is kept in as much as possible, but if there is work to be done in cleaning or separating the oysters, then the owner can run off the water.

Pars or clairs are also dug out, or areas are dyked up so as to hold water, and large quantities of oysters are either fattened or raised to such a size that they can be disposed of for transplanting purposes, or sent into the market direct. Whole families will obtain a livelihood in this way, men, women and children using their united efforts in keeping the household together. It must be remembered that in this system of culture the oyster requires to be handled very often, great attention is devoted in keeping the areas clean; in fact, all their time is given to the cultivation of oysters, and by their energies and perseverance they are often well satisfied with their season's work.

Some of them will commence to strip their tiles in November and December; others will leave till about March, as by that time all their cold weather that will hurt an oyster is over, then these tiles are again cleaned, and on the appearance of the spat ripening in the parent oyster, they must have all the tiles washed with this solution of cement and in the water ready for another season's spat to adhere to; great care and caution is used in placing the tiles, because if planted too soon the tiles become coated with slime, and the floating spat will not adhere to them; then, if these tiles have to be taken out of the water, cleaned again and dipped, the spat may have been emitted and carried away by the tides before the tiles are replaced.

In the year 1874-75 (says Prof. Mobius) there were produced in this bay (Arcachon), 112,000,000 artificially-grown oysters, and in 1875-76 about 196,000,000. This important yield of the last year, as compared with the poor returns of former years, may be accounted for principally through two causes:

First.—The natural oyster beds in the Bay of Arcachon had had complete rest for the entire two years immediately preceding these rich harvests. During the years 1870-71, they had produced only 1,897,000 oysters; but after this period of rest, in November, 1874, 8,500 persons assembled, and in the space of three hours, during which time the gathering was in process, 40,360,000 oysters were taken from the sea. A great number of these were transplanted, as breeding oysters, to the prepared beds, which covered, altogether, an actual area of sea-bottom of 2,669 hectares (about 5,338 acres).

Second.—The former imperfect method of caring for the oysters had been improved to the extent that the young oysters were protected from their enemies and care was exercised that during hot and cold weather they should always be kept under water.

There is about 15 feet rise and fall of tide in some of these localities, the shores are generally sloping from high to low water mark, this gives persons a large area, and a long time to work between tides; then some thousands of trays are required to be made, or kept in repair that it can easily be seen there is very little or no time to be wasted.

The chief cause of success of ostriculture in France is the labour which is devoted to their grounds. It is estimated that over two hundred thousand people find employment from this source around the coast of France, it gives a large revenue to the State in the way of leases of the grounds, it is an industry which is felt throughout the country. These oysters, when shipped from one place to another, whether for transplanting purposes or marketable products, are packed in light boxes, and, as a rule, are placed or packed in boxes separately, each oyster being placed with the deep shell downwards. Being packed in this way, they will keep in better condition longer than if they were measured or counted and thrown into the box until it is full. All these precautions require work and attention. Pretty heavy work has to be undertaken to keep the ground clear. All weeds must be removed, cockle shells and sand laid down where there is not enough, and a good clean floor made if it is not there. Labour, however, is very reasonable, and perhaps that is one of the causes of their great success, a labouring man, if working for a company, can be obtained for about 3 francs a day, a woman will earn 2½ francs, girls and boys about 2 francs. (1 franc equals about 19 cents.)

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To ensure success, labour must be carried on to a great extent, as there are enemies to the delicate young oysters, and if these were not taken care of in the way they are, there would be nothing but failure and disappointment staring them in the face ; this they are aware of, and study their work accordingly. Competition in the trade also adds vim and life to their work, and they are to be congratulated on their success.

After removing the young oysters from the tiles they are placed in oyster trays or cases to keep off their enemies, where they remain for about a month, or possibly longer, in order that those that are damaged may have time to recover ; their growth is rapid in this way ; afterwards they are laid at the bottom of the clairs.

The clairs, which are used chiefly for fattening and greening purposes (of which the French are so fond), are diluted with a little fresh water, and are kept more stagnant than the ponds which are used for growing purposes. Parc owners affirm that the smaller the quantity of water there is in a clair, the oysters, being more exposed to the action of light and heat, consequently grow with great rapidity.

I would like to show that a little pure fresh water may do good to oysters, both for breeding and growing purposes. I have taken the following extract from *Philpot's Oysters, and all about them*, of experiments made by parc owners at La Gironde, in reference to allowing fresh water to mix with the salt for breeding purposes, which is as follows :—

"The basin is fed by means of a large flood-gate, opened at the rise of tide and closed when it recedes. This flood-gate is placed at the head of a channel, the water from which is blended with fresh water at the mouth of a small stream. At first, great care was taken lest this fresh water should mingle with the sea water during the refilling of the basin. For three years the adult oysters placed in the reservoir of observation emitted no embryos, and even grew thin. The experimenters attributed this impoverishment to the too great saltiness of the water, which was so great that it deposited salt crystals on the marine plants contained in the basin. The want of success was evident ; the experiments were abandoned, the oysters removed, and the piece of water converted into a fish pond. From this moment care was no longer taken to prevent the mingling of the waters of the stream of which I have spoken with the sea water in the supply canal, and some time after, in raking the soil, a few oysters were found which had been overlooked. It was noticed that they had developed and grown stronger, and a more extraordinary and an unexpected fact was that traces of spat were found in the neighbourhood of the flood-gate, and of the springs which rise here and there on the banks.

"This wholly fortuitous discovery put the owners on the track of the truth. Some hundreds of oysters were again placed in the basin, and some collecting apparatus which was laid down became covered with spat, and everything went on prosperously."

Artificial production aims at the collection of the embryo oysters, and in this way saves a vast number which, but for the intervention of man, would be lost. It is well known that at the moment of its birth the young oyster is provided with locomotive powers, enabling it to swim in the midst of the sea. After drifting for some time, the young oyster fixes itself on some extraneous body, loses for ever its own locomotive organs, and becomes the mollusc so well known. But these embryo oysters cannot fix themselves indifferently upon any bodies coming within range. These bodies must be sufficiently smooth and clean. It happens, therefore, that in the natural course of things, a large quantity of these minute beings, the spat, not finding any objects to which to become attached, fall to the bottom of the sea and perish. That portion which has become attached under favourable circumstances is for a long period exposed to many dangers, but with the care and attention which is bestowed on these plantations, the mortality is only nominal, and if there is loss in the first instance, it is not felt much, for the older an oyster becomes the harder it is, and is more easily removed to some of the merchants' grounds, who place them in favourable waters until they are ready for market.

The areas cultivated have to be studied, as each or some of them cannot furnish the seed and keep the same in a condition to compete in an open market. Some will engage themselves in securing the seed, and when of a sufficient size, will dispose of them to other merchants whose grounds are so situated and adapted that they will fatten or

green the oyster, as the case is required ; transplanting oysters in this way, where the waters are at all suitable, has a very beneficial effect ; the oysters will often put on a growth of shell, besides increase the size and flavour of the fish.

There are thousands of acres of the French foreshores used this day by oyster growers, and the salt marshes adjoining are converted into rearing and fattening chairs ; and as their business increases, the question often arises among oyster culturists, after they have obtained their spat, where can they find areas to plant their trays. They have solved the problem by making use of very soft areas on the sides of rivers which would be looked upon by culturists of other countries as utterly worthless. In their experience, they have found that if the surface mud is macadamized with sand and gravel, with a coating of shells a crust may be formed that will serve admirably for their cultural purposes. The crust, when formed, is hard to the foot. By this costly means, miles of bay and river banks are constantly brought into a high state of cultivation.

These figures are from the report of Mr. George Michel. He says that in one year the total output was more than fourteen hundred million oysters, which provided labour for about 300,000 persons, and was worth \$2,650,000 in money to France. And this rich harvest was reaped from about 50 square miles of the sea-bottom, which would otherwise have remained entirely unproductive and must, therefore, be accounted an acquisition of valuable territory of far more use to France than many times its areas of African forest or Siamese swamp.

The industry is profitable almost beyond conception, and we are told on another official authority that a crop of oysters valued at eight million dollars was raised in this way upon a farm of 402 acres, while upon another farm of 500 acres, sixteen million oysters were taken in six tides, although there were no oysters to be found there when the farm was established, five years before.

The result of this work is that the natural oyster beds are kept in good order, well watched and moderately worked, become more and more fertile, and the fishery on the beds, which it was feared would disappear for ever, has, on the contrary, become more productive. It should further be stated that in the case of families willing to work, misery has been succeeded by comfort.

OYSTER CULTURE IN HOLLAND.

After explaining the French methods of cultivation, it is hardly necessary for me to go into details with the cultivation of oysters in Holland, as it is carried on in much the same way as in France ; but the oysters are of a superior grade, and of slower growth, owing to a colder climate and longer winter. Parcs, tiles and culch are used to secure the spat, the foreshores are also used as layings for growing purposes, and when winter sets in, those that are not marketed are deposited in a sufficient depth of water to protect them from the frost, snow and ice. The areas are leased for a term of years from the Government, and at the expiration of the term these areas are again leased by auction to the highest bidder.

The grounds are kept in a very high state of cultivation by the leaseholders, and large sums of money are expended in maintaining, dyking and protecting them from falling into state of decay. The competition is keen, and the oysters, when on the market, are next in quality and value to the English oysters.

Further north natural beds are found, although they are not very productive, the soil too, becomes more of a shifting nature, that artificial culture has never been successful along the German coast.

The following is an extract from Dr. Bashford Dean's European methods of oyster culture :—

" Among the European systems of rental of State lands, the carefully devised method of Holland is worthy of consideration, especially as the matter of rental with us will become of greater importance as demand for cultural property increases. State policy in Holland has not hesitated to give short leases at competitive prices ; on the ground that valuable land should not be confined in the hands of one who does not pay for it a just rental, and that the balance established by competition is apt to be the fairest in the end to all interested parties, State, culturists and public at large.

"The prices of leases vary according to location and past results, showing how the value of one locality above another for this and other purposes of oyster culture appears to be gradually established by experience and is, indeed, recognized by those interested in this industry."

The following are a few comparative numbers of the sums for which the same plots were leased in 1870, and the prices realized in 1885 forwards :—

Allotment No. 162, size 12 acres, was leased in 1870 for 1s. 8d. a year; in 1885, £202 a year was charged.

Allotment No. 163, 12 acres, was leased in 1870 for 1s. 8d. a year; in 1885 £227 a year was charged.

Allotment No. 164, 12 acres, was leased in 1870 for 1s. 4d. a year; in 1885, £252 a year was charged.

Allotment No. 176, 12 acres, was leased in 1870 for £22 10s. a year; in 1885, £508 a year was charged.

Allotment 220, 120 acres, was leased in 1870 for £25 18s. a year; in 1885, £83 15s. a year was charged.

Allotment 188, 12 acres, was leased in 1870 for £18 10s. a year; in 1885, £762 10s. a year was charged.

Others have gradually come down in the market as, for example :

No. 280, 24 acres, brought, in 1877, £45 16s.; in 1879, £1 10s.

No. 415, 18 acres, brought, in 1877, £2 1s.; in 1882, 10s.

The fluctuation is, as you see, indeed, considerable, and only rivalled by that mysterious fluctuation of spat which, in the breeding season, is carried to and fro at each turning tide, all through the basin of the eastern Schelde.

It should also be specially mentioned, that after the Yerseke bed had been withdrawn from public fishing, no obligatory close time for oyster fishing was ever prescribed. The lessees could dredge for their oysters at whatever time of the year they liked. That they did not generally do so in summer was, in the first place, for fear of disturbing the growth, the delicate edges of the shell being at this period more particularly liable to break; and, secondly, because the oysters are found to be less palatable at this time of the year.

It will be noticed by the above that one of the reasons of success must be attributed to the leaseholders refraining from selling their oysters during the summer months; although there is no close season, yet their own sound judgment is sufficient to regulate the commencement of the season, which does not begin with them until the weather has become comparatively cool.

OYSTER CULTURE IN ITALY.

Artificial means of collecting spat in Italy has been carried on for years, although the method is somewhat different than that of other countries. It is not carried on to the same extent as in France, as the oysters are not exported in any quantities, and are chiefly used for local consumption and supplying areas in their southern waters with growing oysters. It was here that Coste pictured the successes of the cultural processes of Italy and strongly urged their introduction on the French coast, causing the institution, under the patronage of Napoleon III., of a series of experimental measures, out of whose successes and failures has grown one of the most important of the coast industries of France.

A few extracts from the work of Dr. Bashford Dean on Italian oyster culture, will be very interesting :

"Especially interesting is the fact, already shown by Coste, on evidence furnished by pictured funeral vases, that the processes in use to-day at Tarente, or in the lakes near Naples, are apparently the very ones that the Romans employed as early as the time of Maricus. The oyster stakes of the Lucrine Lake, we are told, represent, in appearance, and actual position, the very ones that Pliny may have inquisitively examined, little thinking that their use would be handed down to posterity more carefully than the volumes of his life-long work.

As one approaches the city of Tarente on the railroad from Brindisi, a very good idea may be obtained of the extent of oyster culture as the road bends around the shore of Mare Piccolo. As far out as one can see the bay is bristling with oyster stakes, whose ends project several feet above the surface. These are soon observed to pass into distant board. These inclosures, which in France would be called oyster parcs, measure about 15 feet square. They are leased at about 50 cents a year, and each culturist secures as many as he can cultivate. They are rented from a joint stock company, which has obtained from the city council the leasehold of the entire bay-bottom, surveyed out in about twenty sections, for an annual sum of \$10,000. The minuteness of the subdivision of this area is the result and also the cause of competition, and the energy of rival culturists adds much to the success of their industry.

The Italian is the very opposite of the French system of oyster culture. French proprietors cultivate the shore lines between the levels of high and low water; their parcs are embanked inclosures, holding a few feet or inches of water until the tide advances; they cultivate their shores in a horizontal plane. The Italians cultivate oysters in all depths of water and make the number of oysters fattened in a given parc stand in proportion to the volume of water. Having but scanty fall of tide, their system has become vertical oyster culture. To cultivate horizontally the French have hardened their muddy beaches, have inclosed tidal areas, and have spread miles of flat cases of iron gauze to furnish growing space for their oysters. The Italian culturist has devised every means of supporting his oysters in the water volume between bottom and surface. In France, owing to unfavourable local conditions, the industry is minutely subdivided.

A parc of several hundred acres may be devoted to collecting the seed oysters, a second parc may be of value in growing the oysters, and a third may serve to fatten or prepare them for transport. A Tarentine parc may represent every branch of the industry; in an area of fifteen square feet a culturist may collect the young oysters, grow, fatten and prepare them for the market.

The Italian process of a Tarentine parc consists, roughly, of corner posts, a web of ropes, and various suspended devices for collecting oysters, growing, fattening and storing them.

The corner posts, firmly implanted, mark the boundaries of the park. At each corner these are usually arranged in pairs, somewhat inclined toward each other, and lashed together a few feet above the surface. Thus fixed, they appear to be quite permanent, especially as their displacement by storm is not usual, on account of the sheltered nature of the Mare Piccolo. The firm calcareous character of the bottom allows the posts to be readily inserted by blows of a heavy mallet. The posts themselves are of green pine, six or eight inches in diameter, are not costly, and are apparently never tarred. The depth of the harbour allows their average length to be about 20 feet. In deeper water, two, or even three, require to be spliced together, bringing, therefore, into culture, a depth as great as forty feet. The ropes forming a network between the corner posts must support the weight of the collecting devices. The cordage must therefore be strong and durable in water. A wire-grass rope an inch in diameter is manufactured in Naples for the purpose. It lasts for one or two seasons, and costs about one-half cent per yard. Baskets are also suspended from the ropes for the purpose of holding oysters which are nearly full grown, and are kept there until ready for market, while others are hung there for spatting purposes.

The arrangement of supporting the ropes are rarely exposed, except where attached to the corner posts. In the parcs established in deeper water the matter of rope management becomes more complicated. The greater amount of rope required by the weight of the cultural apparatus has suggested an arrangement which both separates the cross ropes from each other and enables them to be more easily turned at the corners. With so light a scaffolding to support the devices for collecting and growing the young oysters it is evident that the question of the weight of apparatus has been a very important one. For this reason, as well as on account of lack of tidal ground, the tile, as a device for collecting the young oysters, has been found unsuited. Wood, on the other hand, has advantages, in point of lightness and cheapness. The loose bundles of hazel or gorse

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boughs, termed *fascines*, become quickly water-soaked, and form the most convenient collectors. These, when covered with young oysters, may be broken into twigs and woven into ropes which, when suspended, utilize the water volume from surface to bottom. Oysters that have become detached and fallen to the bottom, together with grown oysters, may be placed for storage and final growth in the suspended baskets.

Thus outlined, the method of culture and its conditions may be more carefully examined. The supply of breeding oysters which furnish the spat is, in any event, large one. The myriads of half-grown oysters lodged upon the suspended ropes spawn prolifically, and this supply is one that never decreases. A second source of spat is furnished by scattered oysters and beds of oysters that have either escaped the knowledge of the culturist or are difficult to secure. General dredging is but little practised. The largest supply of scattered oysters is said to be in the immediate neighbourhood of the parcs where dredging is impracticable. It is certain that the spawning season in the warm waters of the Mediterranean is an extended one, stated by the proprietors to extend from April to October. The greatest set, however, occurs about the end of June. It is clear, however, from fascines that had been put down in January, and which were examined in April, that spawning had taken place during the colder weather, and it may in consequence be inferred that the spawning continues intermittently throughout the year.

The fascines, freshly prepared during the winter, are by degrees taken out during March, April and May, and anchored in deeper water, often in clusters marked with buoys. In the early season the out-going currents are said to be usually the most fruitful in spat, and the culturists arrange their fascines so that they may best be utilized. In May, when the spat is beginning to form in shallower water, the fascines are usually taken up, well rinsed, and, as they are now water-soaked, are suspended in the little parcs. It is here that the fascines get their second crusting with spat, often becoming whitened with accumulated oysters. They are allowed to remain in the better conditions for growth given by the shallower and warmer waters until late in the fall, more often until the following spring. The length of time that the collections are allowed to remain in position appears to be largely dependent upon the character of the season. The collectors from deeper water that have been rinsed and placed in parcs are often added to, if the season appears promising, by fresh fascines, anchored in series and allowed to rise to within a yard or two from the surface. This degree of submergence appears to have been found most favourable for set. At this depth it is certain that the attendants can most readily give them the necessary care. They are clearly seen from above, are readily secured by a cross-barred staff, brought to the surface, rinsed of sediment, and replaced. By this time the oysters have firmly attached themselves to the support, the shells often growing around the slender twigs of the fascine, so that they are apt to be naturally detached, even if the underlying bark has been loosened.

It is not until early in the following spring that the fascines are taken ashore and deposited in huge banks, as a preliminary to weaving the ropes. The attendants now proceed to take them apart, chopping each bough with its attached oysters into twigs about eight inches long. The oyster twigs are now deposited in baskets and are carried to the next attendant, who splices them ingeniously between the strands of rope, so that when completed, the twist of the rope, together with increased weight, keeps the twigs firmly in place. Thus arranged, the rope bristles symmetrically with its oyster bearing burden. Cargoes of these ropes are then rowed to the parcs and put in place. The growing conditions of the oyster now become especially favourable. The heavily burdened ropes swing and vibrate in the currents, allowing each oyster to escape the accumulating sediment and to secure an equal share of the volume of floating food. Their growth is certainly rapid; an oyster three-fourths of an inch in diameter in March, when suspended to the rope, has attained by October about four times its original diameter, and has thus become marketable. Two years and a half, however, are generally allowed to produce an oyster of first grade in the Tarentine market.

Another advantage the culturists claim for the rope system of culture is the ease with which the entire product of a parc can be overhauled, cleared of attached ascidians, mussels and bryozoans, and, in general (the oysters being in plain sight) guarded from

more dangerous enemies. It is evident that rope culture economizes space to a wonderful degree. A single rope 14 feet in length is said to rear about 2,000 marketable oysters. The baskets suspended from the poles are an essential part of the Italian method of culture. In these, stray oysters collected from the bottom, as well as grown oysters taken from the ropes during the process of overhauling, are given their final growth. Storage is thus conveniently managed, the capacity of the baskets being more or less accurately known. The baskets vary considerably in shape and size, the most usual form being loosely woven and shaped like a cheese box. Another device used in giving the oysters their final growth is a net-covered iron ring which, often having a large diameter (five feet), may support four or five hundred oysters.

An important branch of the industry at Tarente consists in the export of seed oysters and of oysters of nearly marketable size, which are intended for fattening in other localities, e.g., Fusaro. Seed from half an inch to one inch in diameter sold during April, 1892, for about 30 cents per 1,000. The price of oysters two years old was then about 80 cents per 100. The average number of marketable oysters produced from each fascine is said to be about 500. The total production of the Tarentine industry can hardly be stated. An estimate, based upon the production of four single parcs, would give the annual yield at about 20,000,000.

Compared with the industry at Tarente, oyster culture in the historic parcs near Naples is decidedly unimportant. A brief discussion of Fusaro and the Lucrine Lake should, however, be given as representing the best types of private industrial establishments, and as illustrating the tidal pond culture of Italy. They are both within a few hours' drive from Naples, and are not over a couple of miles apart. Fusaro, the more northern, shelters under the promontory of Cumae, while Lucrinus, whose size was greatly reduced by the upheaval of Monte Nuova, in 1538, is close to the Roman Baiae. The entire region is one of great interest to strangers, and the inns in the neighbourhood of the oyster parcs owe not a little to those who evade Pozzuoli, hunt Roman villas, and are inclined to dine upon oysters, seriola, and falerian.

Fusaro, described by Coste in 1859, had its industry destroyed about ten years later, partly from volcanic causes, and partly by lack of proper cultural care. Its decadence was caused by the decomposition of organic accumulations which empoisoned the water, by overcultivation of mussels, and by excessive salinity of the water caused by the opening of the second outlet from the lake into the sea. Oyster culture has, however, been successfully reinstated by Sr. Salvator Milosa during the past decade. The present conditions of the lake, and the methods pursued in its re-establishment are therefore of interest.

Fusaro is crescent-shaped, with canals communicating with the sea at either end. It is large, about two miles in circumference, but shallow, averaging perhaps about four feet. Near the southern end, where the large hotel or Casino Reale is built, the water is deeper, shelving at points to about two fathoms. A greater volume of water was secured by dredging out the accumulated sediments, and has proved one of the great causes of recurring success in oyster culture. The former shallowness of the water allowed its temperature to become excessive. The ~~sand~~ process of clearing the basin aided the good results obtained by improving the ingress of a small fresh-water stream at the lake's northern end. By this means it became possible to reduce the salinity of the entire water volume, a cultural advantage which was recognized even in the time of Pliny. He records that oysters became larger and finer in the neighbourhood of river mouths, and that they decrease in size and number in deeper sea water.

The industry at Fusaro is represented in the branches of seed collecting, oyster growing, and fattening. The effects of seasons are also extremely varying, and there can be little doubt that the time of fixation of the spat may, under the best conditions, prove as brief as several hours; although the idea given by Coste that the young tend to settle immediately in the neighbourhood of the parent (e.g., attaching to circumarranged stakes) was long since shown to be untenable. Spat collection is extremely irregular in Fusaro and the Lucrine Lake, and if one is to be guided by the suspicions of rival proprietors, a large part of their industry consists simply in cultivating the seed brought from Tarente. The rearing of the oyster is conducted economically. The oyster is

allowed to remain upon the fascine until it is almost of marketable size, the base of the shell often becoming not a little roughened by its long contact with the wood of the fascine. Oysters that become detached are usually collected and put for final growth in suspended baskets similar to those of Tarente. The French case of wire gauze, which would seem of great advantage here, does not appear to be employed.

The Lucrine Lake, although smaller than Fusaro, is of great interest from a cultural standpoint. Its establishment is carefully organized and maintained; its sea wall forms the highway to Naples; its heavy flood-gate renewes the water through a massive sluiceway projecting into the sea. The present establishment would rival in quality, if not in size, its predecessor, famous in Imperial Rome. Monte Nuova, which sprang up in 1538, is supposed to have greatly reduced the extent of the lake and destroyed its ancient prosperity by volcanic ejections. Lucrines is rich in its associations, and is even to-day in the possession of the family of Pollio, which has long held the property, and may represent the Roman Pollio, whose villa, with accompanying collections of ceramics and slave-fed murcenas was undoubtedly in the immediate neighbourhood.

Like Fusaro, Lucrines has its water perceptibly freshened, but its salinity can be better regulated. At one end of the lake a small canal leads a few hundred feet to a circular pond practically of fresh water, fed by bubbling hot springs, this is connected with a second basin of a bubbling spring of slightly greater salinity. To these sources of freshened water should be added a deep spring in the neighbourhood of the ateliers. Lucrines has but a single disadvantage in that its small size restricts its cultural limits, its extent being but about 10 acres. In proportionately, its depth is greater than Fusaro, its basin shelving gradually to about sixteen feet, and the bottom is less muddy, consisting mainly of tufa and sand. Its temperature was the same as that of Fusaro, its greater depth and its constant communication with the outer water tending doubtless to maintain a greater uniformity in this respect. In the winter season, the influence of the hot springs becomes of great service, favouring the growth both of the oyster and of its vegetable food. The proprietor of the lake favours the continuous introduction of sea water. The fall of tide (20 to 30 c.) is sufficient to allow a proportion of water to pass out and to be replaced. This system has its effect doubtless in preventing the water volume from becoming either too fresh or too warm, and, indeed, the amount of the incoming fresh water would render it decidedly dangerous to close the floodgates for any considerable time. It is, therefore, not remarkable that spat collecting has never been permanently regulated. The yearly success has remained dependent upon favourable conditions of season, i.e., a season producing a sudden and complete spawning, shortening the embryo's swimming stage, and reducing thereby the chances of the escape of the fry through the sluiceway, granting that an embryo would have a greater chance of escape in forty-eight hours than in four hours.

Culture is carried on by the usual method. The stakes support a meshwork of ropes bearing fascines and baskets. Collectors of all varieties are brought into play, bunches of tiles roughly fastened together, and flat stones even being often included. Rearing is doubtless the cultural strength of Lucrines, and the flatteaed wickerwork trays, filled with half and full-grown oysters, are suspended at every possible point of support. The growth appears to be phenomenally rapid; a second year is said to be sufficient to produce an oyster three and a half inches in diameter. The Genoese oyster (*Ostrea plicata*) is occasionally produced, being known here as the *Ostrea reale*, and is exquisite in colour and flavour. Other shell-fish are naturally abundant in the basin, the vongola (tapes) being of especial commercial value. The fish supply entering daily from the sluiceway during the falling tide is often of considerable value. The seriola, suggestive of Roman dinners, is especially abundant here.

It will be seen that this mode of culture is entirely different to either the French or English system; it shows that if the holders are pressed for room, oysters can be successfully cultivated between the surface of the water and the bottom; it appears to be the cleanest way, as all sediment is so easily removed by a slight shake of the rope; the growth, also, is very rapid, owing no doubt to the sheltered positions, mild weather, and the hot springs which abound there.

OYSTER CULTURE IN THE UNITED STATES.

Oysters are to be found on nearly the whole length of the coast line, in some places more plentifully than others. There is such a vast area of water suitable to the natural conditions of the oyster and the demand being so great that the grounds are divided into two parts, one being the public or natural beds of the State, and the other consists of areas of ground brought into a state of cultivation by owners and companies who devote their time and spend large sums of money in order to bring these grounds into a high state of cultivation. After that is done, the first expense being the heaviest, the grounds are kept clean, and oysters are obtained for market at the same time. Oysters are considered so cheap and plentiful that they are eaten by all classes; they are also exported in large quantities to the European markets, also to the Pacific coast for planting purposes. This strain upon the beds has the effect of diminishing the quantity, that it is necessary to protect the oyster to such a degree that, by careful management, the beds will not suffer depletion. Commissioners were appointed in Maryland to ascertain the cause of the oysters becoming scarcer, and in their report they state:

"That the oyster property of the State is in imminent danger of complete destruction. Having reached this conclusion, the next step was to discover the cause of the injury (and that arrived at by various methods was found to be) that the depletion of our beds is not strictly due to any particular method of gathering oysters, nor to the destruction of the young, nor to the working of the beds at wrong seasons, but to the great demand which comes from improved means of transportation, and from the growth of our State of a great commercial industry which has an unlimited and constantly increasing capacity for utilizing oysters. We believe, also, that careful examination of it will convince all of the truth of the conclusion which we ourselves have reached—that the oyster bottoms of our State are of greater value than the dry land, and that they will some day support a great and prosperous population. Their value in the past has been inconsiderable as compared with their possible value in the future, for while the oyster fishermen have never earned much more than two million dollars, it is no exaggeration to state that our grounds are capable of yielding hundreds of millions of dollars annually.

Ingersoll, in his report on the oyster industry of the United States, says that twenty bushels of shells, laid down anywhere in Barnegat Bay, New Jersey, will produce one hundred bushels of oysters; and a Connecticut writer gives the following as the result of three years of oyster farming under wise laws in that State:—"Fifty thousand acres of entirely barren ground, covered, thirty, forty and fifty feet deep by the waters of Long Island Sound, have been made into productive oyster beds, and have multiplied by a hundred fold the production of native oysters. Ten years ago tens of thousands of bushels of oysters were imported from New York, New Jersey and Rhode Island, and now hundreds of thousands of bushels are yearly exported to these States, and to Massachusetts. Millions of dollars are now invested in the industry, thousands of men and women are employed, millions of bushels are in growing crops, and hundreds of thousands of dollars yearly come into the State as proceeds of exported oysters. The oyster authorities have paid more than fifty thousand dollars in the towns and to the State for grounds to cultivate, and pay a yearly tax of a large amount.

According to Ingersoll, 515,000 bushels of seed oysters were, in 1879, taken from the Chesapeake Bay to be planted in Connecticut, and three years of wise management have produced such a change that one firm shipped to San Francisco, in the spring of 1882, 15,000,000 young oysters which had been reared on the Connecticut oyster farms, and were used for planting on the Pacific coast. This State is now able to sell seed oysters to the planters of adjacent States, besides sending an immense supply to Europe.

In the possibilities of the Maryland oyster industry, the following is quoted:—It is a shame that the gifts so lavishly bestowed by nature upon Maryland and Virginia should receive so little practical appreciation. There has been no lack of warning, nor can our people plead ignorance of the true remedy. In a paper (referred to) one of your commissioners discussed at considerable length and warmly recommended a plan which was employed two years after by the people of Connecticut on a very extensive scale, and

with such good effect that the oyster grounds of that State have been raised in three years from a position of insignificance to the front rank. If the importance of helling our oyster bottoms with dead and clean oyster shells had been recognized at the time when we recommended this practice, and if the laws which are needed for its encouragement had then been enacted, our oyster supply would now be in no danger of exhaustion. But this recommendation met with no attention, as it was looked upon as an unpractical view of a student.

In this country oyster culture is an institution of great importance. On the sea-board of this vast continent they are found in natural beds of wonderful extent, and are distributed by means of railways and steamboats throughout the cities and villages of even the far inland districts. Numerous as are the shell-fish shops of London, they are but as one in ten when compared with the oyster houses of New York, in which city oyster-eating appears to be almost the sole business of life, so many people are to be found indulging in that pleasure. The custom is to have the oysters cooked, and this culinary process is accomplished in a variety of ways, the mollusc being stewed, fried or roasted, according to taste. They may be had cooked in about twenty different ways, in any of the well-known oyster taverns of New York, at a few minutes' notice. The great market for oysters is the city of Baltimore, in Maryland, where it is not uncommon for one or two firms each to "can" a million bushels in one year. Immense numbers of these "canned" oysters are despatched all over the States, to the prairies of the far West, to the cities of New Mexico, to the military forts of the great American desert, to the restaurants of Honolulu, and to the miners searching for gold on the Rocky Mountains; whilst fresh oysters, packed in ice, have been sent to great distances.

The following figures will show that Baltimore is the largest oyster market in the world. The average consumption for seven months in the year is 35,000 bushels per day. One firm alone, from October 1st till June 1st, averages 4,000 bushels a day, packing from 16,000 to 25,000 cans daily, hermetically sealed, containing one and two pounds of oysters.

Oyster farming in America, as Philpot points out, which presents some features of resemblance to the French system, and also many differences, has grown up as the result of private enterprise, without any help or any direct encouragement from Government.

Several years before Coste and De Bon commenced their experiments, the oystermen of East River, having observed that young oysters fastened in great numbers upon shells which were placed upon the beds at spawning season, started the practice of shelling the beds in order to increase the supply; and in 1855, or three years before Coste represented to the French Emperor the importance of similar experiments, the State of New York enacted a law to secure to private farmers the fruits of their labour, and a number of persons engaged in the new industry on an extensive scale.

In portions of Long Island Sound, especially off New Haven, it has been needful to make a crust or artificial surface upon the mud before laying down the shells. This is done with sand.

The deep-water cultivators proceed in three different ways to make beds. First, the bottom being properly cleared off, the seed oysters, mixed with the gravel, jingles and other shells, just as they are gathered from the natural beds are distributed thereon more or less uniformly, and there left to grow. Second, the bottom is spread over with clean oyster shells just before the spawning season begins, and brood oysters, twenty-five bushels to the acre, are distributed over the bed. Third, or if the bed is in the neighbourhood of natural beds, the shelled bed is left, without further preparation, to catch the spawn as it is drifted over it. Sometimes the shells fail to catch a "set," and this makes it necessary to rake over the shells the following year, or to cover them over with more fresh shells for the next spawning. There is always an abundance of spawn in the waters of the Sound, and when a set is secured, an enormous crop is the result. On a private deep-water bed, during the past summer, the dredge was drawn at random, in the presence of the commissioners, and from an ordinary sized shovelful there were counted 200 young oysters in excellent condition, of the average size of a quarter of a

dollar. As many as a hundred young oysters have been counted growing on a medium-sized oyster shell.

The beds are carefully tended, and no pains are spared to kill all the enemies of the oysters found among them. By continual vigilance, the private beds are kept comparatively free from them. The larger proprietors of deep-water beds use steamers for this work, as also in doing their work of planting, raking over and dredging, and they use larger dredges than the sail vessels can, as they are also worked by steam, at a great saving of labour and expense. When the oysters have grown on these beds to a merchantable size, they are sometimes sold directly from the beds, but more frequently they are transplanted into brackish or fresh waters, where they are permitted to remain for a short period, to freshen and fatten for market.

The foregoing table affords the ground for the assumption that by the time of the opening of spring work in 1883, 45,000 acres of ground will have been deeded to applicants by the commissioners. These, with the 45,000 acres deeded by the towns prior to May, 1881, will show an aggregate of 90,000 acres held by cultivators under State jurisdiction. Of this vast area a large portion has been cleared up and shelled.

THE OYSTER FISHERY OF CONNECTICUT.

The methods employed in this State are of the greatest interest, for Connecticut has been able, by the adoption of a wise plan, to build up a great oyster industry in a very short time, and to place the business upon a sound and substantial foundation. The natural resources of this State are limited, for upon the most liberal estimate, her natural beds do not exceed 5,000 acres, all told, which furnish a few marketable oysters, and are chiefly valuable as a supply of seed oysters for planting. Three years of efficient protection, under wise oyster laws, have produced such a change that the State, which was so recently compelled to purchase oysters for planting has, we are informed by good authority, this year furnished seed in considerable amounts to New York, Rhode Island and New Jersey, besides sending an immense supply to European planters. One firm shipped, in the spring of 1883, sixty car-loads of seed oysters to San Francisco, from the beds of Connecticut. The sixty car-loads, or more than 15,000,000 young oysters, had been engaged by persons employed in planting on the Pacific coast.

A method which is capable of producing such a result as this, in three years' time, is worth most careful examination. The waters of the State are divided into two districts, a shore district and a deep-water area. In each area there are natural beds, which are open to the public, and private grounds which are appropriated to individuals or companies by law for the cultivation of oysters.

The Public Beds of Connecticut.

The natural beds are open to all residents of the State, at all times except at night; but no one is allowed to use a steamboat upon them, or to use a dredge which weighs more than thirty pounds. The use of steam vessels for dredging upon the public beds has only recently been prohibited. Steam vessels are used upon the private oyster beds, and the proposition to close the public beds to them was warmly attacked, but was finally adopted, and made a law by the legislature in 1881.

In gathering seed near the shore, tongs, and occasionally rakes (those with long curved teeth) are used, but the marketable oysters are nearly all brought from the bottom by dredges of various weights, and slight differences in pattern. In the case of the smaller sail boats, the dredges having been thrown overboard and filled, are hauled up by hand. The oysters themselves are very heavy, and frequently half the amount caught is composed of shells, dead oysters, whelks and other trash, which must be sorted out, thus compelling the oystermen to do twice or thrice the work which they would be put to if there were nothing but oysters on the ground. The work of catching the oysters by any of these methods is, therefore, very tiresome and heavy, and various improvements have been made, from time to time, in the way of labour-saving, from a simple crank and windlass to patented complicated power windlasses, similar to those used in

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the Chesapeake boats. When a proper breeze is blowing, dredging can be accomplished from a sailboat, with one of these windlasses, with much quickness and ease. In a calm or in a gale, however, the work must cease, as a rule. Under these circumstances, and as the business increased, it is not surprising that the aid of steam should have been enlisted; nor perhaps is the controversy which has ensued to be wondered at, since the introduction of novel or superior power into some well-travelled walk of industry has ever met with indignant opposition.

The first utilization of steam in this business, so far as I can learn, was by Captain Peter Decker and brother, of South Norwalk. After the Messrs. Decker's experiment, Mr. W. H. Lockwood, of Norwalk, not an oysterman, but an enthusiastic believer in steam-dredging, built the steamer "Enterprise" expressly for the business. Her length is 47 feet, beam 14 feet; she draws 4 feet of water. She handles two dredges, has a daily capacity of 150 or 200 bushels. These were followed by several other steamers.

The Private Oyster Grounds of Connecticut.

The lands which are thus appropriated are taxed like real estate. And they may be attached or executed upon like real estate. The oyster committee of each town has power to decide upon the sum which is to be paid for the grounds, and the term of years for which they are to be leased. No person can gather any oysters upon private grounds unless they are properly staked or buoyed out, and marked at each corner with the owner's name. The removal of oysters from private grounds, without authority from the owner, is punished by a fine of from \$300 to \$500, or by imprisonment for one year; and the injury or destruction of the stakes or buoys, or the grounds, or the oysters upon them, is punished by a fine of from \$50 to \$700, or by imprisonment from one month to six months; and any boats which are used in violation of these laws are sold at auction, the captain receiving one-half the proceeds, and the town the other half.

Certain towns, however, have a somewhat different law; thus, the town of Guilford has, by special Act of legislature, the right to lease its grounds for ten years to the highest bidder at public auction, but it cannot lease more than five acres to one person. The grounds which are thus appropriated to private parties by the towns are not used for farming or propagating oysters, except in a few cases, but simply for planting, and the seed is either taken from the public beds or is purchased from the holders of private grounds in the area under the jurisdiction of the State, or from persons outside the State. The system does not, therefore, materially increase the number of oysters, but it does greatly increase their value; and it is therefore a great source of wealth to the people of the State, and nearly all lands adapted for the purpose are now appropriated.

Deep-water Oyster Cultivation in Connecticut.

The business of planting oysters in Connecticut, under the provisions which have just been explained, grew so rapidly that all the available inshore bottom near New Haven was soon occupied, and these waters looked like a submerged forest, so thickly were they planted with boundary stakes; and at last Mr. H. C. Rowe ventured out into the deeper water of Long Island Sound, and inaugurated a new era in American oyster culture, by the establishment of an oyster farm in water forty feet deep.

This new departure has led to the development of a new form of oyster culture, which is not planting but farming in its true sense, since the "seed" oysters are seeds in reality, bringing forth after their kind a thousand fold, and thus building up, on private grounds what can be most briefly described as artificial *natural* beds of oysters. The movement which has led to this result is the most important step which has ever been taken in America towards an enlightened method of managing the oyster industry. It has been met at each stage by the most violent opposition, and its history should be of the very greatest interest to all States which control waters in which oysters flourish. Mr. Rowe soon had many imitators, and as oyster culture in deep water cannot be managed on a small scale, the tracts which were appropriated were necessarily outside

the limit of two acres, which was all that was allowed by a strict interpretation of the law.

The rapid development of the industry was watched with angry excitement, and as it was seen that the existing statutes had never contemplated anything of this sort, alterations and amendments rapidly followed one another, now in the interest of the deep-water cultivators, and now in the interest of the owners of the small planting tracts nearer the shore.

The fishermen along shore indignantly opposed the capitalists, and on the ground that everything under the water is common property, openly removed the oysters from private grounds. As there was no survey or exact delineation of the "natural beds," unlimited stealing from private grounds was perpetrated and looked upon with general favour by the great majority of the fishermen, on the plea the grounds in question were "natural beds."

The deep-water cultivators, increasing in numbers and in influence, were able, in 1875, to secure the passage of a law declaring that in a considerable area of the State there are no legally "natural beds," and the possibility of successfully propagating oysters in great numbers, in deep water, was soon proven, and the business continued to grow and to increase in importance, in spite of opposition; but so much discontent existed that a resolution was passed by the legislature of 1879 in its favour.

The following account of the method of laying out and stocking a deep-water oyster farm in Connecticut, and the statement of the attendant expenses, is copied from *Ingersoll's "Report on the Oyster Industry of the United States"* :-

"The process by which a man secures a large quantity of land outside has been described. It is thought hardly worth trying unless at least 50 acres are obtained, and many of the oyster farmers have more than 100 acres. These large tracts, however, are not always in one piece, though the effort is to get as much together as possible. He obtains the position of the ground, as near as he can, by ranges on the neighbouring shores, as described in his leases, and places buoys to mark his boundaries. Then he places other buoys within, so as to divide his property up into squares, an acre or so in size. In this way he knows where he is as he proceeds in his labours. Having done this, he is ready to begin his active preparations to found an oyster colony.

Preparations.

When a cultivator begins the preparation of a deep-water farm, his first act is to scatter over it, in the spring (about May), a quantity of full-sized, healthy native oysters, which he calls "spawners." The amount of these that he scatters depends on his circumstances; from thirty to fifty bushels to the acre is considered a fair allowance here, I believe. The rule is, one bushel of spawners to ten bushels of clutch. He now waits until early in July (from the 5th to the 15th) is considered the most favourable time, when he thinks his spawners must be ready to emit their spat. He then employs all his sloops, and hires extra vessels and men, to take down to the harbour the tons of shells he has been saving up all winter, and distribute them broadcast over the whole tract of land he proposes to improve that year. These shells are clean, and fall right alongside of the mother oysters previously deposited. The chances are fair for catching of spawn. Sometimes the same plan is pursued with seed that has grown sparingly upon a piece of ground; or young oysters are scattered as spawners, and the owner waits until the next season before he shells the tract. Sometimes the ground must be cleaned before any preparation can be begun upon it, by elaborate dredging, or otherwise. Within the harbour, for instance, considerable muddy bottom has been utilized by first paving it with coarse beach sand. No spot where there is not a swift current is considered worth this trouble. The proper amount is 200 tons of sand to the acre, which can be spread at the rate of five sharp loads a day, at no great expense. The sand forms a crust upon the mud firm enough to keep the oyster from sinking, and it need not be renewed more than once in five years.

Expenses of an Oyster Farm.

In either case, therefore, the planter's expense has not been enormous. I present herewith two statements of the outlay under the operations outlined above, which are as follows :-

No. 1.—Fifty acres—	
2,000 bushels spawners, at 30 cents.....	\$ 600 00
15,000 bushels shells, at 3 cents.....	450 00
Planting 15,000 bushels shells at 4 cents.....	600 00
Total.....	\$1,650 00

No. 2.—Sixty acres—	
2,000 bushels spawners at 56½ cents.....	\$1,130 00
17,000 bushels shells, at 4 cents.....	680 00
4,453 bushels Bridgeport seed, at 10 cents.....	445 30
Total.....	\$2,255 30

In a third case, Captain George H. Townsend gave me a statement of the expenses of starting a farm of 25 acres off the mouth of East Haven River. This was a more elaborate arrangement, but, on the other hand, was accomplished through a variety of favourable conditions, cheaper than would have been possible with the ground otherwise situated.

2,000 bushels small river oysters, at 25 cents.....	\$ 500 00
Spreading same and staking, at 5 cents.....	100 00
600 bushels dredged seed, at 40 cents.....	240 00
10,000 bushels shells, put down at 4 cents.....	400 00
Total.....	\$1,240 00

It would not be unfair to average the cost of securing, surveying, and preparing the deep-water beds at about \$40 an acre, or about \$4,000 for 100 acres. To this must be added about \$2 an acre for ground surveys, buoys, anchors, &c. This starts the planter in his undertaking, and if these beds are in an exposed position they are liable to suffer loss by storms, shifting sands, &c.; if, on the other hand, they are well protected by nature, there is the watching and attention to be given to these grounds, as the catching of the stock, after it has matured, or the separating of the seed which must cost a further sum, but when once started, there are always oysters which are caught that can be marketed, so that you are killing two birds with one stone, catching the oysters, and cleaning the grounds.

Management of the Oyster Farm.

Having secured a spat of young oysters upon the cultch which has been laid down for them, they are left alone until they attain the age of three, four or five years, according to the thrift and the trade for which they are designated, by the end of which time they have reached a large size and degree of fatness, if the season has been favourable. If, as is largely done by those planters who live at Oyster Point, the oysters are to be sold as seed oysters to Providence River, or other planters, they are taken up when only one or two years old. Not a great quantity of this seed was so disposed of last year, not over 20,000 bushels, I should say. It is not considered, as a rule, so profitable as to wait for the maturity of the stock.

THE OYSTER INDUSTRY OF NEW YORK.

Many of the natural beds in these waters have been entirely exterminated, but, notwithstanding the great drain upon them which has followed the growth of the city of

New York, many of the beds in East River, and on the south shore of Coney Island, are still in a prosperous condition, and continue to yield fine oysters for food, as well as a valuable supply of seed oysters for planting. The preservation of these beds is no doubt due in part to the prohibition of dredging, but chiefly to the fact that for the last fifty years their fertility has been increased by the practice of shelling them just before the spawning season, and thus securing the attachment and growth of a great number of young which would be lost without this artificial aid.

The methods of oyster farming which are employed by the cultivators of New York have been fully described, and it is only necessary to say here that the efforts have resulted in the preservation of beds which, owing to their proximity to the great centre of commerce and population, have been very heavily taxed by the demands which have been made upon them.

Oyster Laws of New York.

No person who has not been a resident of the State for six months can take oysters within the State, unless such non-resident is employed by a resident.

No dredge operated by steam, or weighing more than thirty pounds, can be used.

No natural bed can be used for planting, or can be staked off for private use.

No non-resident can plant oysters in the waters surrounding Staten Island, without the consent of the owner, and no non-resident can take oysters from the natural beds in the same waters.

No person is allowed to dredge on the natural beds in the vicinity of Staten Island.

Any owner of land adjoining Harlem River may plant oysters in front of his property, where the ground is not occupied, and no person can take oysters from such ground without his permission, under a penalty of \$50.

The penalty for catching or dredging oysters on private grounds in East River is a fine of not more than \$250, or imprisonment for six months, or both.

In Queen's County, any resident may plant oysters in any public waters where there are no natural beds, but no person can hold more than three acres, nor can he hold it unless he uses it for planting.

No person is allowed to take oysters in Great South Bay, Long Island, with a dredge, or in the night, or between June 15th and September 15th, under a penalty of \$250, imprisonment for six months, and an additional fine of \$600 for each offence; half the penalty goes to the informer.

In Suffolk County, any five or more persons who hold oyster lots may form a company or corporation, for the promotion of oyster culture in these lots.

The towns of Babylon and Islip, in Suffolk County, have a special law, which is substantially as follows:—

Any person who is of age, and who has been an inhabitant of the county for a year, may appropriate four acres, where the taking of claims cannot be profitably followed as a business, and upon the payment of \$1 per acre annual rental, and the costs of surveying, he has the exclusive use of the land for the cultivation of oysters, so long as he keeps it marked out and remains an inhabitant of the county; but he is required to pay his annual rent on or before the first day of April, and to plant at least 100 bushels of oysters and shells on the ground, within one year of the date of his certificate, and in case of failure the oyster commissioners have the power to terminate the lease.

Any person may sell and assign his interest in private oyster ground to any inhabitant of the county for one year, but no person can at one time hold more than four acres.

There are three commissioners appointed by the town auditors, with power to determine what grounds shall be appropriated, to make surveys and maps, to settle disputes regarding boundaries, and to receive money.

The unlawful taking or disturbance of oysters on private grounds is punished by a fine of not less than \$100, or by imprisonment for not more than sixty days, or both.

There is no oyster police, but the planters have formed a protective association, and employ private watchmen.

Any inhabitant of the towns of Hempstead and Jamaica, in Queen's County, may appropriate three acres of any lands which are not already appropriated, for the cultivation of oysters; and upon the payment of an annual rent of \$5 per acre, he has the right to use the land for this purpose so long as he remains an inhabitant of the towns. No dredging is allowed in these waters, under a penalty of \$100 fine, or sixty days' imprisonment, or both, and the taking or disturbance of oysters in private beds is punished by \$100 fine, to be recovered by the owner.

According to the statistical summary of Professor G. B. Goode, the oyster fisheries of the United States employ 52,803 persons, and yielded, in 1889, 22,195,370 bushels worth to the producer, \$0,034,861. There is to be considered an enhancement on 18,047,022 bushels in passing from producers to market. This enhancement, which amounts to \$4,368,001 results either from replanting or from packing in tin cans, and increases the value of the products to \$18,438,862. This fishery employs 4,153 vessels, valued at \$8,528,700, and 11,930 boats, valued at \$708,830. The value of gear and outfit amounts to \$712,515. The value of shore property amounts to \$5,633,750. The total capital invested in oyster industry is \$10,583,295. The actual fishermen number 38,249, the shorersmen, 14,556. About 80 per cent of the total yield is obtained from the waters of Chesapeake Bay.

Taking into account all those persons who are directly employed in the fisheries for a larger or smaller portion of the year, those who are dependent upon fishermen in a commercial way of support, and the members of their families, who are actually dependent upon their labours, it cannot be far out of the way to estimate the total number of persons dependent on the fisheries at from 800,000 to 1,000,000. Of the twenty-nine States and Territories whose citizens are engaged in the fishing industry, sixteen have more than a thousand professional fishermen. The most important of these States is, of course, Massachusetts, with 17,000 men. At present, the oyster is one of the cheapest articles of commerce in the United States, and though it can hardly be expected that the price of American oysters will always remain so low, still, taking into consideration the great wealth of the natural beds along the entire Atlantic coast, it seems certain that a moderate amount of protection would keep the oyster seed far below European rates, and that the immense stretches of submerged land especially suited for oyster planting might be utilized and made to produce an abundant harvest at much less cost than that which accompanies the complicated system of culture in vogue in France and Holland.

Extract on the Close Season.

Among the favourite remedies for the protection of the oyster beds, the shortening of the season is a favourite measure, and it has many advocates. This remedy seems, at first sight, to be an effective one, but a little thought shows that it is, in reality, of no very great value. So long as the present oyster policy is maintained, it will be necessary to have a close season to facilitate the enforcement of other legal measures; but it is clear to every one that a good number of fishermen, working upon a bed for a short season, will do just as much damage as a lesser number working for a longer time, we cannot hope that laws to shorten the season will, in themselves, effect any great improvement in the condition of the beds. Thus, overfishing in November is, in this respect, just as bad as overfishing in May.

At any time before the end of May, the disturbance of the beds can do little harm, and the experience of the Connecticut oyster farmers shows that the thorough raking of the beds, just before the spawning season, is a positive benefit. The young oysters cannot attach themselves to dirty and slimy shells, and if all the sponges, hydroids and seaweeds could be dragged from our beds in April and May, and if the old decayed and slimy shells could be ploughed under, and covered with cleaner shells from below the surface, by dredging just before the spawning season, the fertility of the beds would be greatly increased, and there is, therefore, nothing in the nature of the oyster to demand the closure of the beds in April and May.

Enough instances have been given to show that the prohibition of dredging will not save any bed which can be reached with tongs, and as the dredge is a much more

scientific, effective and economical apparatus than the rude tongs which it has superseded, there does not seem to be any reason why its use should be prohibited. In one way the use of dredges is a positive advantage to the beds. The dead shells which are found on an unworked bed are usually so covered with sponge, slime, and other substances, that they furnish no clean surface for the attachment of spat; and as dredging tends to turn up clean shells, to break up and scatter the clusters, and to tear away the sponges and other foreign bodies, it is a positive benefit to the beds; the teeth of the dredge take hold of the rank growth of the oyster beds, and by being dragged through them, loosen them and give them room to grow and mature properly; moreover, beds are continually increased in size, for when the vessel runs off the beds with the nets filled with oysters, the oysters and cultch are dragged off on ground where no oysters existed, and thus the beds are extended; and when the vessel is wearing or tacking to get back on the oyster beds, the catch just taken is being culled out, the cullings thrown overboard forming new cultch for drifting spat to adhere to. Many persons who do not advocate the total prohibition of dredging, believe that the size of the dredging boats, and the size and weight of the dredges, should be restricted by law. They give two reasons why the size of the boat should be restricted, urging that the large boats are able to work upon the beds when the police boats cannot venture out, and that their size permits them to use very large dredges, and thus catch great quantities of oysters.

It is asserted that the use of large dredges causes much evil, as they ruin the beds by crushing or smothering or burying in the mud more oysters than they capture; but the private farmers of Connecticut find it to their advantage to use much heavier dredges, and their farms improve under this treatment, although very heavy dredges are hauled by steam over the beds, even in the spawning season.

The cause of the exhaustion of the beds is because the demand has outgrown the supply. There are only two possible remedies. Either we must diminish the demand by killing the packing industry, which has created it, or we must increase by artificial means, the natural supply of oysters. The tongmen know that most of the oysters have been taken away by the dredgers, and they therefore advocate the prohibition or restriction of dredging. Ignorant of the fact that in localities where no dredging has been allowed the natural beds have been exhausted by tongmen, just as soon as a demand for the oysters sprung up; they believe that the prohibition of dredging is all that is needed to restore the beds. The dredgers, on the other hand, attribute the injury to the law which allows the tongmen to take oysters for private use in the summer, forgetting that the beds of Connecticut are rapidly increasing in value under a law which allows not only tonging, but dredging as well, all through the year. The small dredgers and scrapers hold that the larger vessels are destroying the oysters by the use of heavy dredges, although the Connecticut farmers find it to their interest to use on their own private beds far heavier dredges, which they drag over the beds by steam. Many of the oyster packers who carry on their business only in the winter, believe that all the damage is due to the oystermen who fish in March, April and May; and men who have money invested in the oyster business in Maryland believe that the exportation of oysters in the shell, and especially oysters for planting in northern waters is the cause of the mischief. We can hardly be surprised that our people should exhibit total ignorance of the true cause of the destruction when we recollect that there is not a single word in any of the laws of Maryland which indicates that our legislators are aware that the supply of oysters can be artificially increased, or that there is need for any such increase. It was suggested by Lieut. Winslow that a policy should be adopted similar in essential features to that of Connecticut. The fishery of that State is one of the few instances of recuperation on record.

Unnecessary Destruction of Young Oysters.

One explanation which has been urged to account for the destruction of our oyster beds is the wanton or unnecessary destruction of young oysters. Upon the piles of shells which are thrown out from the packing houses, great numbers of young shells can often be found. They are, of course, dead, and as they are too small to be of any use,

their destruction is a clear loss to our people. It is impossible to prevent this from happening occasionally, as in many cases the little oysters are so small, and so firmly fastened to the old one, that they cannot be removed without destroying them. We believe, however, that in cases where great numbers of young are fastened to the large ones, the use or destruction of them at the packing house should be discouraged. This difficulty will disappear with the growth of the planting industry, for small oysters will then be valuable as seed, and they will pass into the hands of the planters instead of going to the packing houses. The true remedy, therefore, is the encouragement of planting, and if our people would develop this business immediately, all need for special legislation would disappear.

It has taken our people nearly two hundred years to discover that we cannot afford to destroy oysters in this way; we can hardly expect them to perceive that clean, empty shells are also so valuable that their use for lime, &c., should be prohibited. One of the commissioners called attention to the very great value of oyster shells, and showed that a great increase of fertility would follow the return of the shells to the waters of our bay.

The preservation of the oyster beds, Professor Goode regarded as a matter of vital importance to the United States, for oyster fishing, unsupported by oyster culture, will, within a short period, destroy the employment of tens of thousands, and the cheap and favourite food of tens of millions of citizens.

Oyster Planting.

Oyster planting is the placing of small or "seed" oysters upon bottoms which are favourable to their growth. Planting also adds very greatly to the value of oysters, as they grow more rapidly, and are of better quality when thus scattered than they are upon the natural beds, and Ingersoll quotes the statement that \$18 worth of small "seed" oysters yielded, after they had been planted for two years, oysters which were sold for \$114, besides about thirty bushels, which were used as food by the planter's family. Oyster planting can be carried on only on private grounds, and it cannot flourish in a community which does not respect the right of the private owner to the oysters which he has planted.

The industry does not require a large capital, and it can be carried on with profit on a very small scale, although the oysters need constant and intelligent attention. In all places where it has been employed it has greatly added to the prosperity of the communities which have engaged in it, and has greatly increased the population of the shores along which it has been encouraged and protected.

Private Culture.

The history of French oyster culture is of very great interest in this connection. Nearly twenty-five years ago the French Government undertook the cultivation of oysters, in order to restock the exhausted beds. The Government farms were at first very successful, and they not only proved that oyster farming is very profitable, but they also served as a school for the instruction of the public in the methods of oyster culture. This example was followed by private cultivators, and the private industry upon the French coast is now in a very prosperous condition; but a government report (Oyster Culture in Morbihan) upon the subject; in 1875, contains the statement that "the worst merchant in France is the state." The state lacks that powerful lever called individual interest. An occupation is not possible unless an assured profit may be realized from it. The merchant alone can be certain of this, from a study of the markets and the demands of the consumers. The poorest merchant in France is the state. The state has quite another part to play. Charged with the protection of all, it cannot descend from this elevated sphere of general usefulness into the arena where opposing interests of commerce are contending. We do not wish in any way to diminish the gratitude due to those whether functionaries of State, or others who have laboured for the

creation and development of this industry : but we feel the necessity of proclaiming in a certain measure the omnipotence and vigilance of individual interest.

This industry has paid a profit of not less than 100 per cent annually upon the capital invested in the business, while money thus invested in other states has paid an annual interest of more than 200 per cent.

One firm laid down 250,000 bushels of shells. Several large growers have laid down as many as 200,000 bushels each. A still larger number have scattered a hundred thousand, fifty thousand, and twenty thousand each. There are about thirty steamers engaged in the business, besides a very large number of sailing vessels. It does not admit of a doubt that the business of oyster growing, as carried on in the waters of the sound is exceedingly profitable.

With regard to transplanting the oyster and its transportation, all experienced persons were of the opinion that delicacy in handling, and freedom from jars, concussions and shocks of any kind, were desirable. Oysters, when under hatches, have very frequently been killed by heavy thunderstorms and firing of guns. Any concussion or sudden shock will prove destructive, if they are in a confined space. Oysters taken up during the summer are much more susceptible to injury from this cause than those obtained during the winter.

Oysters are transplanted at any and all seasons, but generally in the spring and autumn.

Results of Leasing Areas.

Before the inception of the examination of the oyster area of the State, the industry was not only insignificant, but had every prospect of remaining so. The examination and survey have directly or indirectly entirely changed this condition of affairs. When widespread ignorance as to the real condition of matters existed in the past, intelligent comprehension of all phases of the question is found in the present. In place of ignorance of the positions and areas of the natural beds and possibilities of oyster culture, is a general diffusion of knowledge on both subjects. Instead of continual strife among those who worked the common and those who worked the private beds, there is practically general harmony. Where, under cover of law, robbery of the common property was carried on by one class and depredations on private property by the other, now exists a complete restriction of both. The rights of the public and of the individual are equally protected.

In place of what was virtually discouragement of enterprise in this field, is now liberal encouragement to all who will venture labour or capital in the development of the area. Instead of an insignificant business, yielding little to the individual and nothing to the State, a new industry, promising wealth and prosperity to the individual and increased income and importance to the State, has begun its existence ; and, finally, confidence in the future may be substituted for the fear of disaster to the greatest of American fisheries.

The Chesapeake beds may and probably will be destroyed through the excessive and illegal fishing they undergo ; the oyster farms on Long Island Sound may continue their struggle with star-fish and inclement weather—with the ravages of man and nature ; but so long as North Carolina holds open her hundreds of thousands of acres of territory to the cultivator, the oyster industry of the country, employing its thousands of people and its millions of capital, cannot perish.

The Fishery and its Effects.

An extract from Lieutenant Winslow's report : "The oysters are removed from the beds in the James River with the tongs alone, no dredging being permitted, and this may account to some extent for the beds being made up of patches and ridges of oysters. This formation is only advantageous in so much as it assists the rapidity of the current, and, in all other respects, it is an evil. Beds such as Cruiser's Rock, Nasemond Ridge, and Point of Shoals, when the oysters in places are too thick, would be much improved

by using a light scrape or dredge, instead of the tongs in the fishery. If used with moderation, the surface of the bed would be cleaned, its area extended, the oysters would be more evenly distributed and allowed more room for development, and the spat, having a larger and cleaner amount of "culch exposed, would probably attach in greater numbers."

Information given by Oystermen.

The cause assigned for the deterioration, and even the admittance of the fact, depended very much upon the occupation of the informant. The tongers, or those who pursued the fishery with tongs alone, were unanimous in laying the deterioration to excessive dredging, while the dredgers, or those owning pungles or other vessels employed exclusively with the dredge, while they admitted the decrease in the number of oysters, laid such decrease to the action of natural and unexplained causes, arguing that the evident extension of the beds and improvement of the oysters, due to dredging, was sufficient to prove its good rather than its ill effects.

With regard to the depth of water and character of bottom, shallow water was preferred, and sticky mud, or mud and sand, about six inches in thickness over a hard substratum, was considered the best, though a larger amount of mud did not matter, provided it was not so soft as to allow the oysters to sink in it, and had a strong current over it.

The oysters were said to feed on the flood tide, having their bills open then and at no other time. No one had noticed any enemies or animals that preyed upon the oysters, and all seemed ignorant of the drills and their destructive effects.

The oysters are "culled," that is, they are separated from the old shells and other débris, while the boat or vessel is on or near the bed. Everything except the oyster is thrown back, sometimes striking the bed and as often the mud. The young oysters, under a year and a half in growth, and less than two inches long, are also thrown back.

All persons interrogated were of the opinion that at least 75 per cent of the oysters on a bed are taken off each year, and that no more than 50 per cent should be removed.

The spawning season was said to be from May until August, inclusive, though most of the spawning was done in June and July. All opinions coincided that the oyster in shoal water spawned first, but different as to whether, the depth being the same, all oysters on the same bed spawned at or about the same time, as many being for as against the theory. Currents were said to have no effect upon the spawning. Oysters of one year's growth, three-fourths of an inch long, have been seen with the spawn in them, and oysters on natural beds were thought by the majority to spawn sooner than the planted ones, though there was not much difference. Oysters transplanted with the spawn in them, however, will cease spawning. A wet or warm spring would hasten the time of spawning, but would not shorten its duration.

The young were supposed to "strike" every three years, though there was but little regularity about it, a bed sometimes running for ten years with a young growth on it every year, and then failing to produce anything for two or three years. Sometimes one part of the bed will be covered by young and another totally barren.

The difference in time of spawning, in shoal and deep water, is probably due to difference in temperature, the deeper water naturally being of the lowest. The establishment or the refutation of this supposition, as also that of the difference of the times of spawning is very necessary, especially of the latter, as it would afford a sure basis for such legislation for the protection of the beds as will soon be necessary. Mr. Rice, in searching for spawn in the oysters during the latter part of August and first part of September was unable to discover any except in those from deep water, and that fact, together with the inference drawn from preceding paragraphs, leads me to believe the oystermen are correct in stating that there is a difference in the time of spawning of the shoal and deep-water oysters.

CANADIAN OYSTER INDUSTRY.

The preceding general description of the methods used in some of the European countries, and in different parts of the United States, serve as a sufficient model or example of

what has been done, and also the business which might be developed in the waters of the maritime provinces and British Columbia, if capital and energy were brought to bear upon this valuable branch of the fishing industry.

During my visits of investigation in New Brunswick, Prince Edward Island and Nova Scotia, I have found, among the people there, an evident desire to learn everything relating to the culture of oysters, and I have no doubt that with the material assistance which this department is prepared to give to those willing to embark in this business, the day is not far distant when the whole coast of New Brunswick and Nova Scotia, from Caraquet to the Strait of Canso, including the waters in the island of Cape Breton, as well as the shores of Prince Edward Island could be made to yield a handsome revenue to the provinces, while being of no small importance to parties desiring to engage in this lucrative business on their own account.

Up to the present time very little attention has been devoted to the private or artificial cultivation of oysters upon reserved areas. We must consider the area of the public beds, the fishermen that fish upon them, their rude modes of fishing, the reckless way in which the beds have been destroyed by cutting them to pieces during the winter months by means of mud diggers, worked by horsepower (the contents of which are transferred to farms and utilized as a fertilizer on their lands), the fishing for oysters through the ice during the winter months (which, I am pleased to say, has since been stopped), all helping to deplete the beds (as the young and immature oysters being left on the ice to freeze and perish through the severity of the weather); the indiscriminate and illegal fishing, everything in the shape of an oyster being carried on shore, irrespective of size. All this has been carried on for years, it is no wonder then that complaints are received of areas becoming exhausted and unproductive, or that they cannot stand the strain which is brought to bear upon them, that areas are becoming smaller in size, and in many cases are entirely mudded over, choking and killing the few remaining oysters that were on the beds. The methods used in taking oysters are with single-handled rakes, and tongs; dredges are very little used.

Oysters being a valuable article of food, are the means of bringing large sums of money to the districts where they are grown, caught or cultivated. As our areas are gradually being fished out, it is for us to take steps to prevent their extinction, if possible. Now that there are such facilities for the transit of perishable goods, the demand is far greater than the supply, hence one of the chief causes of overfishing. Being public grounds, every fisherman considers he has a right to fish while there are oysters to be caught, so that the stock left on the grounds for breeding purposes, in some instances, is very low. The only way to avoid this, is by granting leases or areas to resident applicants for the cultivation of oysters under their own care. These private layings will be watched, guarded and improved. The public areas would not be so heavily fished upon, and if small ones were taken from them, it would be to transplant them to a private bed, instead of being added to the pile of dead oyster shells, of which so many are to be seen around the packing houses and landing places, no one caring what becomes of them, although they are one of the chief causes of exhaustion of the beds, which, if left on the fishing grounds, would become the very backbone of the oyster industry.

Speaking of public oyster fishing areas, it is seen that with few exceptions the beds are gradually but surely becoming depleted, as every one considers they have a right to fish, and no one cares to try and improve the beds, for if one person attempted to do so there would be one hundred that would do just the opposite. Under ordinary conditions, each natural oyster bed is able to yield a certain number of oysters each year, and whenever this number is taken in excess the beds suffer, and if the practice is continued it must eventually be destroyed. To restrict the fishery to any great extent would, in effect, deprive many of the poorer class of people of a portion of their substance and means of livelihood, neither is it necessary beyond the actual close time, except in extreme cases, to do so. My impression is that the general effect of a lengthened close season is simply to gather the oyster fishermen upon the beds in greater numbers than ever at the opening of any particular area that has been reserved. No mere restriction of the fishing can possibly accomplish the desired object, and it is only a matter of time before the end comes.

The following regulations, if carried out, no doubt would materially assist this branch of the fishery; they were passed by Order in Council, dated 28th day of December, 1893, and are as follows:—

1. No person shall fish for or catch oysters without a lease or license from the Minister of Marine and Fisheries.

2. The owner, person, or persons interested in a fishing boat employed in the oyster fishery shall cause a memorandum in writing, setting forth the name of the owner, person, or persons interested to be filed with the local fishery officer, who, if no valid objection exists, may, under instructions from the Minister of Marine and Fisheries, issue a fishery license for the same, and any boat or fishing apparatus used without such license shall be deemed to be illegal and liable to forfeiture, together with the oysters caught therein, and the owner or person using the same shall be subject to the penalties prescribed by the Fisheries Act.

3. All boats fishing for oysters shall have a registration number corresponding with that of the license legibly marked or painted on the bow of the boat, in white coloured letters on a black ground, and the initial letter of the port to which such boat belongs, such letters to be at least eight inches in length.

4. Oysters shall not be fished for, caught, killed, bought, sold or had in possession, between the 1st day of June and the 15th day of September, in each year, both days inclusive.

5. Fishing for oysters, or any other shell-fish, through the ice is prohibited.

6. No person shall fish for, catch, kill, buy, sell, or have in possession, any round oysters of a less size than two inches in diameter of shell, nor any long oysters measuring less than three inches of outer shell.

Round oysters of a less size than two inches in diameter, and long oysters measuring less than three inches on the outer shell that may be accidentally caught, shall be returned to the water alive, at the cost and risk of the person so fishing, on whom, in every case, shall devolve the proof of actual liberation.

Provided always, that persons holding fishery licenses may obtain from the Minister of Marine and Fisheries, permission to fish for and catch small oysters for the purpose of planting, or stocking oyster beds.

7. Fishing for oysters is prohibited on Sunday, and from sunset to sunrise on any other day of the week.

8. No person shall dig mussel mud within 200 yards from any live oyster beds, and then only at such place or places as may be prescribed in writing by a fishery officer.

9. The use of rakes for the purpose of taking oysters on any beds prepared or planted by the Department of Marine and Fisheries is prohibited.

Oysters will find a resting place on various kinds of soil; they are to be found on rocky and stony bottoms, attaching themselves to twigs and branches of trees that may be lying in the water, or any other hard, clean substance. The oyster is also found on shelly and muddy bottoms. It will live and thrive in mud as long as it is not too soft to become entirely buried, and has free access to running water. Such oysters are generally long and irregular in shape, with a soft chalky shell, while an oyster taken from a firm bottom will not, as a rule, be so large, and the shell is composed of a harder substance; such is more regular in shape, especially when found singly. Oysters that grow in clusters are chiefly found on areas where there is a lack of proper cultch, and naturally attach themselves to each other. If these areas were dredged upon, it would loosen the sediment which would be carried away by the tide, cleanse the shells, remove the weeds and extend the area, which would be much cleaner than it is at present, as the oysters are fished with a rude kind of rake, which contracts rather than extends the beds.

If all our oyster areas were divided up into private holdings, the whole could be watched, its condition and capacity much more carefully and exactly ascertained, than can ever be the case under State management, and an enlightened system of private cultivation would be the most sure safeguard against the exhaustion of the beds.

The only obstacle in the way preventing the development of such an industry among us is the existence of the sentiment that since the oyster grounds belong to the whole

people, they are not in a proper field for private labour and industry. Fish have always been regarded as common property, because it is not within the power of individuals to improve them, or increase their numbers or value, but this is not true of oysters. An oyster is as subject to improvement by cultivation as a garden root, and the cultivation of oysters is therefore a perfectly proper and legitimate employment for capital and labour, and the common right to the beds must in time give way to private enterprise, just as surely as the common right to the natural products of the soil has given way before the progress of civilization. Such a change as this cannot be brought about rapidly without causing imaginary hardships or ill-feeling, and it is therefore best that it should come slowly, but the common right to all our people to the use of the oyster beds is a very different thing, from the right of a portion of our people to exterminate the beds; and since it is plain that the interests of the whole people demands an immediate change in our oyster industry, steps should now be taken to render possible the growth of our oyster farming industry in the future.

Theoretical oyster culture seems so simple, that the wonder is there are so many failures at it. When we come to put our theory into practice, we begin to find how many local circumstances there are, apparently trifling in themselves, which really exert a powerful influence on our calculations; and it is only by many years of watchful observation that any one can acquire sufficient experience to be able to understand, and cope with the numerous difficulties which will beset the path of an oyster grower. If, however, we were asked to sum up the principles of oyster culture in as few words as possible, we should say: Keep your cultch clean, keep down the vermin, separate from the collectors as soon as possible, protect from frost during the winter, keep the oysters quiet during the spatting season, and hope for warm, calm and settled summer weather.

I will now deal chiefly with grounds that would be kept and attended to by private culturists, as I believe the above course is the only hope for the oyster consumer to secure his stock. As the grounds are now so overfished it must be plain to every one that the supply of oysters in the future must rest entirely upon the products of private enterprise rather than from public areas. With this end in view, the Department of Marine and Fisheries have for the last few years granted areas of ground covered with water, or foreshores, in the form of a license or lease to persons applying for areas where no actual oyster fishing is carried on, that is, where an oyster fisherman can obtain a livelihood, such areas are reserved for the public, but where a bed has become depleted through overfishing, overgrown grass or weeds, mud, or other causes, such areas can be applied for, or areas where no oyster fishery ever existed, leases have been issued on application and on payment of \$1 per acre per annum, payable in advance, the applicant paying all charges for obtaining plan and surveys, &c. The forms of application were as follows, with regulations to guide surveyors in preparing plans and descriptions for applications for oyster fishery licenses.

APPLICATION FOR OYSTER FISHING PRIVILEGES.

To.....

.....180

The undersigned hereby applies for a License of Oyster Fishery Privileges at..... in the County of....., Province of....., covering the following limits, as shown on a plan of survey accompanying the present application:—

(Here insert description of limits, by metes and bounds, showing connection with previous surveys made, or with some well-defined boundaries on shore. All surveys to be made by a duly licensed surveyor, in accordance with the printed regulations issued by this Department.)

Signature of Applicant or Applicants.....

REGULATIONS to guide Surveyors in preparing Plans and Descriptions for Applications for Oyster Fishing Licenses.

(1.) All surveys of Oyster License Limits are to conform to the largest scale Admiralty Chart published, of the harbour or locality to which the application refers. Such Chart can be seen on application to the Fishery Overseer of the District in which the limits are situated.

(2.) Boundaries are to be fixed by reference to well-defined objects marked on the Charts, or by any Surveyor's boundaries already existing, but in these last cases, the Surveyor's boundaries must be defined for platting on the Chart by reference to points marked on the Chart, so that they can be accurately located by the Officers of the Department from the Surveyor's description.

(3.) Where surveys are bounded by lines, these lines must be due astronomical east and west and north and south lines.

(4.) The extremities of any lines, or other boundaries, when on land, must be marked by monuments in accordance with the law governing land surveys.

(5.) The boundaries of lots, when in water, must be so defined that they can be easily located at any future time. Satisfactory definitions would be two cross ranges on land, separated by an angle of at least 60 degrees, with the objects in range defined on plan, or at least three sextant angles, each of not less than 40 degrees, measured to four prominent objects on shore shown on the Chart. Compass bearings alone, unaccompanied by any other check, will not be accepted.

(6.) A plan of the survey must be furnished, which is to be made on the basis of the Admiralty Chart of the locality, as above mentioned, either on the same scale or some multiple thereof, or it may be platted upon a printed copy of the Chart. On the plan, all boundaries, distances, bearings and connections, with reference points, must be distinctly shown, and an error, clerical or otherwise, will condemn the whole survey.

(7.) The plan must be accompanied by a description giving the metes and bounds of the lot and its area in acres, in such terms as would, in the case of an ordinary land survey be held in a Court of Law, to be a legal description for a title deed.

(8.) In the event of previous surveys having been made in the same locality, the plan is to show the nearest boundaries of such surveys, and their relation to the new survey.

After the application and plan are complete it is submitted to the inspector of fisheries for transmission to headquarters, with his report of the area in question, and if approved of by the department, a form of license is made out in his favour for a period of nine years, on a form similar to the following :—

OYSTER AREA FISHERY LICENSE.

No.

Dominion of Canada,

Province of

Special Fishery License issued under authority of Sec. 21 of the "Fisheries Act."

18...

The herein named....., resident of....., County of....., in consideration of the payment of the annual sum of.....Dollars, is hereby licensed for the term of.....years, to plant and form Oyster Beds and to Fish for Oysters within the following waters, that is to say :

(Full description of limits given.)

The present license is granted under the following conditions :—

- That the Licensee shall use and apply the privileges hereby granted for the planting, breeding, culture, production and fishing of Oysters, and uses connected therewith; and for no other purposes whatever.

2. That the Licensee shall, at the expiry of each year, make a return verified by statutory declaration, showing :-1st. The number of Oysters planted ; 2nd. The number taken ; 3rd. The number exported ; and 4th. The number sold in Canada each year under the present License.
3. That the Licensee shall neither concede, nor transfer, any interest in the present License, without the written consent of the Minister of Marine and Fisheries, or other person or persons duly authorized by him to such effect.
4. That the boundaries of the waters covered by the present License shall be marked by the Licensee with suitable stakes and buoys, and with the number of the lot plainly marked on the north-west stake or buoy.
5. That in default of payment of the annual rent or any part thereof \$..... yearly, in advance, the present License will become null and void.
6. That should the Oyster bed hereby licensed not be, in the opinion of the Minister of Marine and Fisheries, properly cultivated or protected by the Licensee ; the privilege hereby granted will be forfeited.
7. That the Licensee shall, at the expiry or determination of the present License, deliver up the possession of said privileges without any claim to remuneration or indemnity.
8. The Licensee shall not interfere with the operations of fishermen within the limits so leased who may be lawfully engaged in fishing for or catching any kind of fish other than oysters.
9. The present Licensee shall strictly conform with the various provisions of the Fishery Acts now (or hereafter) in force, and with all Regulations made by the Governor General in Council, and with all the written or printed Directions he may receive from any Fishery Officer ; and in default of compliance with the same or any of them, the License will become void, and forfeited forthwith. The Licensee shall, however, nevertheless remain liable for any penalties that he may have incurred by violating the law.

For Minister of Marine and Fisheries.

Countersigned and dated atthis.....day of.....189

.....Fishery Officer.

After having secured a license for an area, the next step is to commence operations on this marine farm. The first thing is to ascertain the nature of the bottom, if it is clean, or dirty, hard or soft, even or uneven. If dirty, it should be dredged over and cleaned, the weeds, if any, should be removed and the bottom made as even as possible. Should the area consist of an old depleted bed, the turning over of the old shells will greatly benefit it.

In planting oysters no hard and fast rules are given. If oysters are found to thrive in certain waters, it is as well to continue cultivating them on the same area.

Great care should also be taken to plant oysters in a sufficient depth of water to protect them from frost and ice during the winter months, upon a firm bottom, of from 4 to 6 feet depth at low water time in sheltered places. Deeper water would be advisable where areas are more exposed to the weather, on account of the ground swell breaking upon the beds.

As to the working of oyster beds, an eminent authority has said it is utterly useless to enclose a piece of ground and simply plant it. It is also useless to throw a lot of oysters down among every state of filth. One must keep constantly dredging, not only the bed itself, but the public beds outside, so as to keep the bottom fit for the reception and growth of the young oysters, and free of its multitudinous and natural enemies. An oyster ground is naturally dirty in the summer. Seaweed grows rapidly in hot weather. Weeds collect mud, and consequently, as the summer advances, the grounds become dirtier and dirtier.

I will now give an explanation of the dredge and its uses in oyster culture.

Oyster Dredges.

In preparing grounds for cultivation, the main object is to have a clean area to begin with. The most efficient, effective, and economical method in this case is the use of the dredge, which is a triangular shaped instrument, consisting of a bit or rake nearly three feet long, made of flat iron about two inches in width and set at an angle so that it comes in contact with the ground, behind which a small bag-net is fitted, and made to hold about a bushel, this will receive and collect all the bit of the dredge has turned over. The sides of the bit are joined to two pieces of iron about three feet six inches long and welded together at the upper end to which a ring is fitted, a rope is attached to this ring, and in this way it is towed and brought to the surface when required. It is also strengthened by a piece of iron running from the ring down the centre two thirds the length of the sides, and connected by a cross piece of iron holding the two outside limbs in their place which strengthens the frame considerably; to it also is secured the upper side of the net. The bag or net, is so constructed that the lower or underneath side is generally made of iron or galvanized wire rings and made into a netting, because there is more wear on the lower side, as it is dragged over the bottom of the ground, and most of the weight of the contents lay on that side, while the upper side is an ordinary piece of common netting made with strong twine, this being much lighter, it fills out forming an open-mouthed bag by the action of the water running through the meshes while the dredge is being towed over the grounds. The lower end of the bag is kept square by means of a stout stick attached to both the lower corners, this keeps the net from fouling, and also acts as a handle when emptying the contents of the dredge on deck. The dredge is towed behind a steamboat or from the weather side of a sailing boat, the boat being allowed to fall to leeward and forge ahead slowly, the length of rope being regulated from the deck, by the depth of water the bed is lying in, speed of the boat, and the conditions of the weather. After a little practice it can easily be ascertained whether the dredge is full or empty, or is catching anything or not, by feeling of the dredge-rope, if everything is satisfactory, a strong vibration is felt on the rope as the dredge is being dragged over the bottom and the weight is found to increase, sometimes the boat is going too fast, or the line may be too short, and the dredge does not even touch the bottom, this is called swimming the dredges, and can only be adjusted and regulated by practice, both as regards the speed of the vessel or the length of rope.

Where dredges are worked by hand it is not desirable to have them made too heavy, it would be a greater advantage to work two lighter ones than one heavy one; and that fault alone would often prejudice many persons against their use. The iron frame-work of a dredge weighing about 20 lbs. is a very fair weight for a hand dredge. The lighter the line the better it will fish as there is not so much resistance against the water. The result is that the dredge is towed lightly over the beds, collecting all surface shells, stones, weed, oysters, brood or any other substance or matter that lies in its way. If oysters have been planted, or are laying on the area, they are caught much faster than by the ordinary methods now in use in this country. Large quantities of oysters may be caught in the course of a day from a well stocked bed, by the use of the dredge, a large item would be noticed in the course of a season in the way of saving labour, it being far more economical and satisfactory to use a dredge than any other implement or method. It also disturbs the sediment or silt which is naturally carried away by the currents, and the result is the grounds are cleaned while the oysters are being caught for market, it keeps the areas level and if the shells are old and decayed they may be removed to the outside edges of the bed, the dredges are sometimes towed to the extreme length or breadth of the cultivated area or even beyond it, the shells and refuse often being thrown overboard outside the edges of the bed, and if this is continued it can easily be seen that the beds must become more extensive, and the result is that by the use of dredges the beds are increasing in size, while the methods now in use are of no value whatever in cleaning or keeping an area in order, and only tend to contract rather than extend the beds as is the desire of any one wishing to make an improvement and success on anything that is undertaken.

Oysters and other kinds of shellfish can be taken by this method in any depth of water. Oysters are thus caught from the beds at Whitstable, England, where they lie in about six or seven feet at low water, there being a rise and fall of tide averaging about twelve feet. They are also caught in the North Sea off the Dutch coast in from twenty to thirty fathoms of water, and other places where the depth varies from one to thirty fathoms. The shape and weight of the dredge varies with the locality and nature of the bottom where the fishermen intend working; a dredge is made much heavier and wider for deep water than for shallow water, and dredges vary in weight from twenty to eighty pounds and upwards.

All those persons who have used oyster dredges in this country speak very favourably of them. I am certain that when the dredge is once fairly introduced and its merits thoroughly tested, it will supersede both the rake and tongs, and open up a new feature in the private cultivation of oysters.

Dredges are also used in England to obtain the whelk, which is used as an article of food and also a valuable bait for cod-fishermen. It is likewise used to catch mussels and starfish, utilized by the farmers as a fertilizer, and quite a number of men find employment in loading their boats with them for the different markets.

The Soil.

Oysters cannot thrive where the ground is composed of moving sand, or where mud is deposited; consequently, since the size and number of these places are becoming very limited, only a very small percentage of the young oysters can find a resting place, and the remainder perish. By putting down suitable cultch immense quantities of the wandering spat (or fry) may settle on it, and thus be saved. As a rule, the natural beds occupy most of the suitable space in their own vicinity. Unoccupied ground may, however, be prepared for the reception of new beds, by spreading sand, gravel and shells over muddy bottoms, or beds may be kept up in locations for permanent, natural beds, by putting down oysters and cultch, just before the time of breeding, thus giving the spat a chance to fix themselves before the currents and enemies have had time to destroy them.

The simplest form of oyster-culture is the preservation of the natural oyster-beds. Upon this, in fact, depends the whole future of the industry, since it is not probable that any system of artificial breeding can be devised on these shores, on account of protecting the seed during the long winter, which will render it possible to keep up a supply, without at least occasional recourse to seed oysters produced under natural conditions. It is the opinion of almost all who have studied the subject, that any natural bed may in time be destroyed by over-fishing, by burying the breeding oysters, by covering up the projections suitable for the reception of spat, and by breaking down, through the action of heavy dredges, the ridges which are specially fitted to receive the future spat.

Professor Huxley quotes: "As regards the future of the oyster industry in Great Britain, the only hope for the oyster consumer, lies in the encouragement of oyster culture, and in the development of some means of breeding oysters under such conditions that the spat shall be safely deposited."

Great care should be taken of the spat, as the older it is, the harder it becomes, and if the young are saved the future may be looked forward to by reaping a good harvest. The living and dead shells of the adult oysters furnish the best surface for the attachment of the young, and for this reason the points where oyster beds are already established are those where the young have the most favourable surroundings and the best show for life. The beds thus tend to remain permanent and of substantially the same size and shape. It is well known that shell fish of all kinds thrive best where the supply of lime is the greatest. The dead oyster shell is soon corroded and in a few years almost entirely dissolved by the seawater, and I think this fact is another reason why the young oysters thrive best on a natural bed. How far the supply of oysters is limited by the supply of lime, it is impossible to say, but when we recollect how important it is that the young oysters should soon find solid bodies to fasten themselves to, and that they should protect themselves by strong shells of their own as quickly as possible, it will be seen

that the danger of exterminating a valuable bed by over dredging would be much less if the empty shells or cultch were replaced on the beds.

Cultch is the name given to the debris of shells, stones, &c., which are found at the bottom of the sea, on or near oyster beds. It has been the practice from time immemorial to supplement the natural supply by throwing down deposits of this sort on oyster grounds. Oyster and cockle shells make the best material for this purpose; in default of this, stones and pebbles may be used, the great point being that the cultch, whatever it is composed of, should be clean, and for this purpose the shorter the time it is laid down before the spat falls the better.

Shells may be collected from oyster saloons and deposited near the shore, exposing them to the weather, the sun and rain, frost and snow will have the desired effect upon them, they will be thoroughly cleansed of all organic or other matter, and when laid upon the oyster beds are excellent spat collectors, they also serve to make a firm foundation in extending an area if required by the planter. Or they may be obtained from oyster beds taken in the dredge when fishing for oysters and laid on shore in heaps until required for use, or when enlarging an area may be deposited there each day as they are caught according to the discretion of those who have charge of the work.

Whenever the natural conditions will admit of it, the yielding capacity of an oyster bed may be increased by improving and enlarging the ground for the reception of the young oysters. The natural banks should be improved by removing the mud and seaweed with dredges, also by scattering the shells of oysters and other molluscs over the bottom. When circumstances will permit, all vermin which are taken in the dredge, which kill oysters or consume their food should be destroyed; in England this collection is generally used as a fertilizer upon the fishermen's vegetable gardens, thus it is a benefit in two ways, by removing them from the oyster beds and placing them as manure upon gardens.

After an area has been prepared the next step is to stock it, and it has often been observed that the removal of oysters from one ground to another has the general effect of improving both their flavour and size. The spring of the year, before the hot weather sets in is the best time for planting. By placing the oysters in shallow water during the spring and summer months, they will grow much faster than if placed in deeper water, as the sun causes the water to become much warmer, the oyster being very sensitive to the action of light and heat which promotes a rapid growth. Oysters planted in the autumn are not so likely to thrive, as owing to the change of soil and falling temperature, the oyster is not properly climatized before winter sets in, which very often proves disastrous. Oysters grow but little during the winter months, with the exception of getting thicker, consequently it is all risk or loss with little or no gain although there are exceptions in every case. Young oysters taken in the spring will have survived the winter, the change of water and temperature becoming warmer, gives the oyster every chance to live and grow.

In obtaining the necessary quantity of oysters for planting purposes extreme care should be taken of securing them in a fresh condition, and if time will admit of it, to overhaul these oysters and brood very carefully, and if they are found to be in clusters they should be separated as much as possible either from other oysters, shells, stones, or anything else they may have adhered to. This separation gives the oyster a better chance to grow into its natural shape, as oysters grow much better singly than when in clusters or bunches. In securing the stock the size of the oyster should be considered, for which I give the following reasons: Small or young oysters planted on a bed are preferable, as their growth alone will result in large proportionate returns and profit. A young oyster is not so likely to die when transplanted to another bed, as when older, nor is it any advantage to transplant a full grown oyster unless for immediate use. In the oyster trade of this country one great advantage is the rapid growth of the bivalve, when as is the case here, they are bought and sold by measure.

Time may also be devoted when cleaning an area, or catching the stock for market, to separate any small oysters that may have attached themselves to full grown oysters or shells that have been brought to the surface in the dredge with other cultch, and in this way a person is always improving his own grounds which he will soon find out to

his advantage. Experiments have been made by the department with depleted beds at Shediac, N.B. The areas there have been cleaned and restocked with young oysters, which have grown very fast, are full of life, and on several of the oysters and shells there are traces of spat, from the smallest size up to the full-grown bivalve; the ground being clean and of healthy appearance. On one portion of the bed oysters were planted from Curtain Island, P.E.I. These oysters have grown very much more than those which were obtained from Buctouche or Cocagne, although the latter are in splendid condition.

The wealth within the reach of our people and their descendants, from the oyster grounds in our waters is almost beyond belief, and it is not too much to affirm that their money value is more than equal to that of dry land.

Temperature of the Water.

During the time whilst engaged in the provinces, I paid strict attention to the temperature of the water, and see no reason why there should not be a spat fall each year, if the grounds are in a suitable condition. The temperature gradually rises during the summer months until it reaches about 70 degrees, when it gradually falls, giving ample time for the spat to become attached to any object, and start growing before the winter sets in. The waters in the bays and rivers are admirably adapted for the cultivation of oysters in that respect. In the annual report for 1890 I have submitted a table showing temperature, place and date, for three successive years.

Close Season.

The close season is at present from 1st June to 15th September; while this is against the popular notion that no oysters should be eaten during the months without an R, I think the dates are well chosen. In Ireland the close season extends from the 1st May to 1st September, but the Fishery Commissioners have power to alter it; and have exercised such authority in numerous instances. In England, the close season is from 14th May to 4th August, which often proves to be the hottest month of the year. No doubt, the 1st October would, in some ways, be preferable in Canada; but the season, now that winter fishing is prohibited is already so short, lasting a little over two months and a half, that it would seem very hard to further curtail it. If the weather gets warm in the latter end of September, it is the shipper's business to use his judgment in sending oysters to market. That is one great advantage of a person holding a license for an area of oyster grounds; he can meet the demands of the market without overstocking it, by sending the best quality and size, leaving his small ones to develop into full-grown oysters.

In the first place it is imperative that whatever close time is required shall be honourably and conscientiously observed; as there is nothing to be gained by supplying oysters to the public during the summer months, if oysters are caught for market during these months, the grounds would be disturbed, the supply of breeding oysters lessened, and it would be impossible to calculate the amount of death and injury caused to spat, young brood, and immature oysters, by securing a small quantity of oysters in order to satisfy the palate of a few fastidious persons who are entirely ignorant of what they are eating. The close season should be as well observed, not only as far as the oyster is concerned, regarding its breeding qualities; but at that period it is really not in a fit condition to be eaten, and fatal cases have been reported through eating oysters during the hot weather.

I may also state that it is just as injurious to fish oysters through the ice as it is during the hot weather and spawning season. Where this practice has been carried on, as has previously been done on most beds, heaps of refuse, consisting of dead shells and mud are found; large numbers of dead young oyster shells are also found bleached by exposure; the loss of oysters in this way must have been enormous. Where the ice does not actually rest on the beds it has the practical effect of protecting the oysters from changes in the temperature. This has proved to be the case in Ostend, Belgium, where the oyster parcs happened to freeze over. Originally they were always breaking

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the ice, thinking it might hurt the oyster to be frozen over, but they suffered great mortality; upon being advised to let the ice remain they found scarcely any death among them, and have since that time always allowed their pares to freeze.

Frost sometimes congeals the shells together, and the oyster dies from starvation. Shells have been opened and the oysters found enveloped in ice. In this state, though dead, it is perfectly good, if eaten at once, but when thawed the dead oyster quickly becomes putrid. In winter, after a thaw, snow water comes down the rivers, increasing the volume of fresh water which sometimes causes great mortality to the oysters.

It is a very noticeable fact, although one might think that under water the weather would make no difference to the ground but such is not really the case. — only when the weather is mild that the soil below the surface of the water becomes close and soft, and in these places oysters and brood are often taken, but when the weather becomes cold the ground becomes close and hard, and oyster brood cannot be taken at all in the very same place where it was taken previous or just after the cold weather. This is another example that it is injurious to work too much upon the beds during the winter months.

It has been noticed that during the last few years oysters have been taken in very fair quantities from the river flats and areas that dry at low water, but these areas are not always to be depended upon in their yield, as they are placed in such an exposed locality, being subject to the frost. It makes a great difference when the frost sets in on areas such as these, if the frost comes with any force during spring tides when these areas dry at low water it is nearly always fatal to the oyster, if on the other hand the ice makes during neap tides and remains, it acts as a covering and protection to the oysters, and when the ice actually rests upon the flats the soil is sufficiently soft to allow the oyster to be pushed into the mud until the ice rests on the whole area, in such cases the oyster will live, but where the oyster is exposed to the frost by low tides and heavy winds, the oyster itself becomes frozen, which means certain death, especially to the half-grown ones. This was particularly noticed on the flats at Davies Point, Orwell River, P.E.I., covering an area of about seven acres: in 1896 over 1,000 barrels were picked up. That winter the ice made during low spring tides which appeared to kill nearly everything off, as there was not one-fifth taken from there the following year. Pownal Bay was found to be in the same condition; this has been noticed and watched by practical men.

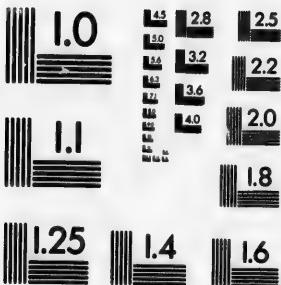
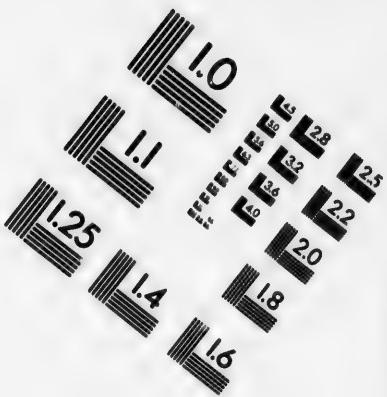
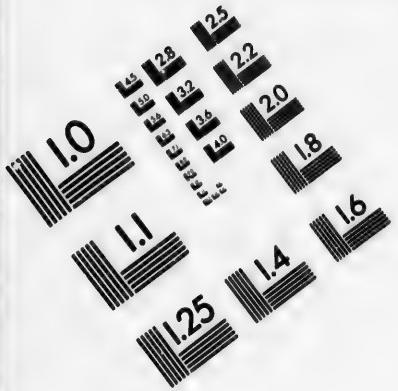
The following extracts are taken from a special report by Professor Edward E. Prince, Commissioner of Fisheries for Canada, in the department's annual report, 1895. It is entitled, *Peculiarities in the Breeding of Oysters* :—

"In studying oyster propagation, the first important fact to be noted is this, that each oyster originates in an egg of extremely minute size. This egg is like a round ball, but soon assumes the form of a somewhat oval body. Each measures about one five-hundredth part of an inch in diameter, so that five hundred of these eggs in the case of our Atlantic oyster (*Ostrea virginiana*, Lister), would cover an inch if laid side by side. The English oyster (*Ostrea edulis*, L.) produces much larger eggs, no less, in fact, than one two-hundred-and-fiftieth of an inch in diameter, or more than twice the size of the oysters' eggs in our Canadian water.

"Each egg has the character of a minute grain of soft living matter, practically invisible to the naked eye, and unprovided with any protective shell or hard membrane. These eggs are produced by special organs in the mature oyster at a particular period known as the breeding season, to cover which period legislative prohibitions have been enacted in all civilized countries. These special organs form a network imbedded in the fleshy body of the oyster. The network is made up of very delicate canals, with pockets or follicles at intervals, and it is in these follicles that the eggs arise. The eggs, when ripe, pass down the fine canals into a main duct on the right and left side of the oyster. These larger right and left ducts open into the fore part of a slit or depression,

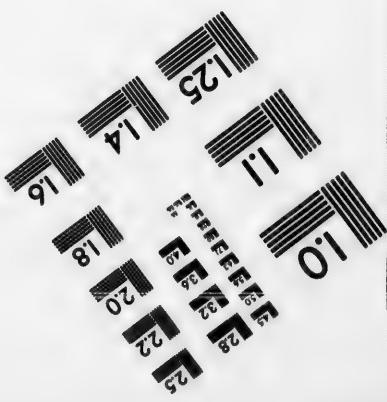
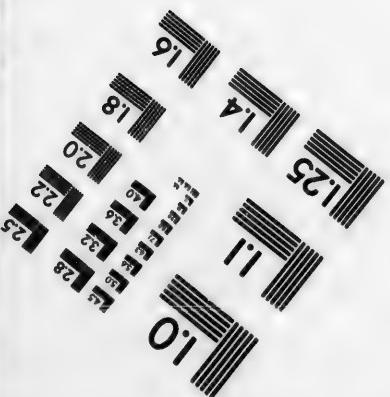


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into which also the kidney or organ of Bojanus opens. The depression is really in the mantle cavity or chamber of the oyster, which may be also called the shell chamber, and it passes generally down close to the great adductor muscle.

" Before an egg can grow into an oyster it must receive a peculiar granule of living matter, the sperm particle, which is the male element. The egg must be regarded as a female product. When the two are fused, fertilization is completed, and the egg produces a young oyster. The sperm-particles are exceedingly minute, so small, in fact, that a myriad of them simply appear as a drop of creamy fluid. Eggs and sperms can be distinguished from each other by a trained expert without the aid of any instrument; but when magnified under a powerful microscope, the appearance of the two is wholly dissimilar. The late Professor Ryder discovered a chemical test of a very efficient character, for when using a mixture of methyl green and sanfranin (a saturated alcoholic solution), he found that the eggs were always coloured red and the sperm granules appeared of a blue-green colour.

" The two elements (eggs and sperms) are formed in different individuals in our Atlantic oyster. In other words, the male oyster is distinct from the female.

" In the species referred to (excluding the European species) when the female is ripe, the eggs travel down the tubules into the large ducts, and finally reach the cavity of the mantle, or shell-chamber, as it may be called. The eggs are so minute and light that when the oyster opens its shell, the rush of water carries them out. They float away into the open water, and occur in such countless myriads that the surface of the sea on some oyster beds is quite cloudy with them. A female Atlantic oyster may pour forth, in a single season, fifty to one hundred millions of eggs. When sheo, they have not undergone the essential process of fertilization. Only contact with the sperms produced by the male oyster can accomplish that. The eggs are, therefore, sterile, and will produce nothing unless vivified or fertilized. Now the male produces great quantities of sperms, which pass into the shell chamber just as the eggs do in the female. These sperms are simply washed out into the open water, so that they come into contact with the floating eggs, if the weather and other conditions be favourable. Countless numbers of both eggs and sperms fail to achieve this, and, of course, perish. Neither eggs nor sperms, if they are kept separate, survive very long. When the egg is penetrated by a living sperm, it rapidly changes its appearance and structure. These complex changes need not be described here. They proceed while the egg, an almost invisible floating speck, is carried about in the sea. In the space of a week, more or less, according to the temperature and season, the little egg becomes an active embryo, provided with a delicate shell. It soon settles down and becomes attached to any available object.

" It is possible that deterioration of oyster beds may arise, at times, from a serious disparity in the relative numbers of the two sexes, in the case of the Atlantic and Pacific oysters, at any rate.

" Under favourable conditions, however, such is the number of sperms poured into the sea by a single male, and such is the quantity of eggs produced by each female, that the perpetuation of the beds is ensured, unless unusual circumstances intervene. One sperm suffices to fertilize a single egg.

" The European oyster does not produce more than one or two millions of eggs, which are thrown out as black spat. It has, therefore, not one-hundredth part the fecundity of the Atlantic oyster, but the young have the advantage of maternal protection until somewhat advanced, instead of being emitted into the open water, while still in the first and most frail condition. In all the species, however, a very minute proportion of the embryos or 'spat' ever arrive at maturity, and apart from the perils which beset them when floating in the sea, there is always the danger that the places upon which the spat settles, or falls, may present conditions fatal or, at best, very unfavourable. Artificial culture attempts to avoid these perils and to overcome these most serious disadvantages.

" The following summary exhibits the more important differences between our Canadian oyster and the European species:—

"Canadian Oyster."

- "(1.) Sexes separate.
- "(2.) Unfertilized eggs shed by parent.
- "(3.) Eggs and sperm meet in the open sea and fertilization is accomplished.
- "(4.) The swimming embryo is naked and has for a time no shell.
- "(5.) Number of eggs enormous, probably 50 to 150 millions produced by each female oyster.

"European Oyster."

- "(1.) Sexes combined in the same individual.
- "(2.) Eggs never shed before fertilization.
- "(3.) Eggs fertilized and retained within the mother-oysters' shell.
- "(4.) Embryos protected by a thin shell, and emitted as 'black spat.'
- "(5.) Eggs do not exceed one or two millions, i.e., one egg for every hundred eggs produced by the Canadian oyster."

Oysters will spat in shallow water sooner than they will in deeper water, owing to the difference of temperature at the different depths.

They will breed long before they are full grown, very probably in the first year of their age; certainly in the second. Their productiveness appears to reach its maximum at five or six years, and afterwards to decline; but much further observation is needed before any certain knowledge is acquired.

The state of the weather, however, has a serious influence on the spawn, and on the adult oyster power of spawning. A cold, wet and windy season is very unfavourable, and a decidedly cold day will kill the spat, so that it will be seen that while in the embryonic state young oysters are very delicate and susceptible to cold. If the temperature of the sea suddenly drops many degrees, they all close their shells and fall to the bottom dead, just as a frosty night will "nip up" and cause to fall off from the branches the delicate blossoms of fruit trees. If, on the contrary, the weather continues of a warm and equable temperature both day and night, and if it be at the same time calm, the young oysters will have a chance of taking up their positions on the various substances they love best, viz., stones, gravel, empty shells, living oysters, and other clean hard substances.

In this connection I quote from Philpot's "*Oysters and all about them*":

"A controversy hinged upon whether an oyster, while on the bed, lay on the flat or convex side. Mr. Frank Buckland, who originated the dispute, maintained that the right, proper and natural position of the oyster, when at the bottom of the sea, is with the flat shell downwards; but the natural position of the oyster is of no practical importance whatever; and I know from personal observation of the beds at Newhaven and Cockenzie, that oysters lie both ways, indeed, with a dozen or two of dredges tearing over the beds it is impossible but that they must lie quite higgledy-piggledy, so to speak.

"There have been several other disputes about points in the natural history of the oysters—one in particular as to whether that animal is provided with organs of vision. Various opinions have been enunciated as to whether an oyster has eyes, and one author asserts that it has so many as twenty-four, which again is denied, and the assertion made that the so-called eyes projecting from the border of the mantle have no optical power whatever; but, be that as it may, the oyster has a power of knowing the light from the dark. Fishermen say that if the water is clear where these creatures are lying in their beds, they may be seen to close their shells whenever the shadow of a boat passes over them."

The oyster is not gifted with any kind of locomotion, except during its earliest stage, remaining afterwards stationary throughout its life.

In the ports at St. Joseph's, in France, which are most exposed to the inclemency of the weather, the oysters are turned, and laid on their flat sides. This ingenious arrangement renders the animal less accessible to the action of the cold, and gives the shell a firmer position, thus preventing it from being too easily lifted by the surf, and from being thrown to a distance by the violence of the sea.

OYSTER FOOD.

In discussing the question of oyster food in its many aspects, the general character should first be examined. The oyster, it is well known, is quite an epicure in its feeding, preying almost entirely upon the minute, lowly organized plants that float or swim in its neighbourhood. With its shell slightly opened, and with the dark-coloured sensory margins of its mantle protruding, it draws into its shell a narrowing food-bearing water current. When it once draws in the current, it carefully screens out the minute food particles, and passes out a stream of filtered water. It avoids, if possible, ingesting sand or mud. Oyster food, it will be found, consists mainly of diatoms, a particular kind of minute, lowly organized plants that have the remarkable power of moving freely about in the water. Unlike any other plant, they are incased in a pair of saucer-like glassy shells, fitted one to the other like the lid to a pill box. The glassy cases of the minute plants appear in no way to inconvenience the oyster's digestion. The mucilaginous sheathing that encases prominently many diatoms, is first dissolved, and the digestive juices find their way through the intricate glassy valves, speedily attacking and reducing the jelly-like contents, together with the inclosed golden-brown pigment pellets. The emptied diatoms appear to settle gradually, and are soon brushed by countless cilia from the stomach to the intestine.

The Whitstable oyster merchants and fishermen have an idea that constant dredging tends to fatten oysters, by bringing them in contact with a wider food area, and this opinion is not contrary to that of the most experienced Essex merchants.

An oyster requires a clear, clean current of water of sufficient strength to carry off all excrement of the oyster, and other foul matter that may have previously been deposited on the area, either by the preceding tide or lodged there accidentally. Saw-dust, mill rubbish, and heavy soil drainage are very injurious to any oyster bed, and such sites should be avoided if possible.

Fresh water does not harm in moderation, and when mixed with sea water, the oysters, when young, appear to fatten and grow more quickly where they are subject to the effects of numerous fresh-water deposits, but with too much fresh water, the oyster increases in size, it becomes fat and flabby, and eventually the oyster gapes and dies, with the appearance of bursting themselves open.

OATMEAL AS A SUPPOSED ARTIFICIAL FOOD.

As this will probably fall into the hands of others than those who actually cultivate oysters, but who are fond of them, and are in the habit of keeping a small supply on hand, it is advisable to point out that some persons, through ignorance, have an idea that oatmeal, flour, or other mealy stuffs diluted in water with salt are beneficial to the oyster, and think that it will fatten it; this notion is absurd in the extreme, as it will only hasten its death. Meal of any description, when wet, will naturally swell and eventually turn sour, and it is in this case when given to the oyster, the mealy water will enter the shell, filling the fish with this offensive matter, choking the oyster in much the same way as sand will, the consequence is, the oyster puffs up, turns a deathly white in colour, loses its flavour, becomes very insipid, and if left long in this state will soon die, while persons are under the impression the oyster is thriving. Let any person, if he choose to keep oysters after they are caught, try the following experiment:—Place the oysters in a barrel or other receptacle, putting each oyster in separately with the deep shell downwards, pack as tightly as possible, and cover over with a wet cloth or sack, keeping the air and draught from them. The oysters will feed and fatten in their own liquor, and I am confident they will be found in a much better condition, their flavour being preserved, will be more palatable, and, being firmer, they will keep much longer than if placed in oatmeal and water.

THE ENEMIES OF THE OYSTER.

There are some who would imagine that the cultivation of oysters is a matter of small importance, and when the area is planted there is nothing further to trouble

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about until they have grown large enough and are ready for market, but I must call your attention to the facts of the case, when you will see that it is not all sunshine with the oyster culturist; some of the items referred to will be found in the following pages, beginning with the

Fivefingers, or Starfish.

The following is quoted from *Philpot*:—"No person would have thought, on placing an oyster and a five-finger side by side, that the starfish was a relentless foe to the oyster. Those who can remember their first fruitless endeavours to open an oyster may naturally wonder how the starfish can achieve such a feat. As I have repeatedly seen, it proceeds as follows:—Clasping the oyster in its rays, it brings its mouth opposite the hinges. From the mouth it pours a secretion which paralyses the hinge-muscle, and causes the shell to open. It cannot, like a dogwhelk, extract its prey and put it into its stomach, so it reverses the process, and puts its stomach into, or rather over, the oyster, protruding the stomach from its mouth, surrounding the oyster with its coats, digesting it, and then withdrawing the stomach into its body. The wildest fancy of Oriental legends never equalled in grotesque imagination this perfectly true history of the oyster and the starfish.

"But although the starfish can, in this extraordinary manner, manage to devour an oyster as big as himself, it must evidently be somewhat troublesome to him, for he prefers to attack oysterbeds covered with "spat," "brood," or "half-ware,"—that is, oysters from one to three years of age—whose shells are not so hard, and whose flesh is more delicate and pleasing to the enthnodermal stomach.

"Starfish will also feed on mussels which themselves destroy oysters by smothering them, and on whelk-tingles, dead crabs, barnacles, &c., so that, after all, they may do some good, as a certain amount of vermin in a game preserve is anything but injurious to the welfare of the whole population; the vermin keep up the balance of nature by destroying and eating the sick and weakly animals, which might otherwise die a lingering death."

Sea Urchins.

The next on the list of the oyster's enemies is the Echinii, "sea eggs" or "sea urchins," whose well-known empty cases are so common on every shore. The body of the sea urchin consists essentially of an exterior shell, or solid corona, covered with spines, and invested in a delicate membrane, furnished with vibratile cilia. This corona is formed of an assemblage of contiguous polygonal plates, adhering together by their edges. The plates are so arranged that the shell is divided into vertical zones. These zones are of two kinds, one being very much larger than the other; the plates of the larger zones are covered with sharp spines, which are movable, and serve at once for protection and locomotion. The plates of the smaller zones are pierced with pores, from which issue filaments, by which the animal breathes and walks.

It can travel either on its back or stomach. Whatever their posture, they have always a certain number of feet which carry them, and suckers with which they attach themselves. In certain circumstances the animal walks by turning upon itself, like a wheel in motion.

Nothing is more curious than to see a sea urchin walk upon smooth sand. One of the most singular organs of this interesting animal is its mouth. It is most curious. Placed underneath the body, it occupies the centre of a soft space invested with a thick resisting membrane; it opens and shuts incessantly, showing five sharp teeth projecting from the surface, the edges meeting at a point, supported and protected by a very complicated framework, which has received the name of Aristotle's Lantern. To this formidable mouth is attached an oesophagus, or gullet, and an intestine which extends along the interior walls of the corona, describing the circumference of its principal contour.

That sea urchins are regarded as vermin in the oyster parks has been proved by the following evidence:—In the month of May of a certain year, a sudden inroad of these

sea urchins was discovered in the Paglesham fishery (Essex), and by the month of August of that year they had eaten an enormous quantity of oyster spat, the size of a split pea. Frank Buckland noticed several of these creatures on the oyster beds in Kilkerran Bay, near Ballynoohinch, Galway, and naively remarks, "that they were not there for nothing."

Dogwhelks.

The "dogwhelk" or "whelk-tingle" (*Purpura lapillus*) is extremely injurious to oysters, and destroys them in vast numbers. Frank Buckland speaks of them as follows :—These dogwhelks seem to find in a short space of time where the oysters may be found in numbers, for my friend Mr. Browning, tells me that not very long ago some fishermen found a bed of oysters out in the mid-channel deep sea. These oysters were, at the time they were found, not large enough to be dredged up and taken away to lay down on private beds, so the dredgers determined to leave them till they grew to the proper size. They had not, however, calculated upon the whelk tingle, for these rascals, soon after the departure of the fishermen, found out the bed as well as the fishermen, and were there before them, killing every one of the oysters, leaving only the clocks, or empty shells ; and when the dredgermen came next year to take up the oysters, they found nothing but whelk tingles and fivefingers, but no oysters. The whelk tingle gets at the meat of the oyster by boring the shell with his sharp tongue, which causes the mollusc to open its valves. Rewards are offered by the oyster proprietors in England for these whelk tingles, paying one shilling a bucket for them.

Lieutenant Winslow reports, "another enemy of the oyster, particularly when young, is the Astyrus, discovered in Chesapeake Bay, near Crisfield, Md. Also the rough whelk (*Uroalpinx cinereus*) is known to do great injury to the oyster in Long Island Sound, and the destruction of the young alluded to in his previous reports as due to drills may be effected by this animal. That large numbers are destroyed by the whelks cannot be doubted ; but as it is possible that the Astyrus may also assist in this destruction, a more extended investigation o' this question, than I was enabled to make, is desirable."

Seaweed.

Seaweed of every description should be removed from all oyster beds, as it increases the work of dredging, covers up the oysters and grounds, and at the season of spattering it covers the cultch, so that the spat that settles there is lost. Weeds also collect mud, which would smother the spat even if it found a resting place, and generally makes foul and dirty ground. The oyster areas cannot be too clean for the reception of spat, and the cultivation of oysters.

Seaworms.

Seaworms, some of which are of great beauty, are also enemies to the oysters. They bore through the shell at all points. Frequently the oyster will resist the invasion of the enemy by depositing some pearly matter between its tender body and the mouth of the invader, and thus compel him to beat a retreat. But others are not so fortunate ; for in the holes drilled by the seaworms a preparation is often made for the assaults of a parasitic sponge, which insinuates itself and eats further than its predecessor into the oyster, causing the softer parts of the shell to rot away, and spreading through the whole substance of the oyster like a dry rot in wood, until vitality is destroyed, and its loosened shell becomes detached and empty on the waters.

Sand.

Amongst the inanimate enemies of oysters, Frank Buckland makes special mention of sand and frost :—" Of all inanimate objects which are inimical to the oyster, there is nothing more fatal than sand. If we consider the highly sensitive and delicate structure of the oyster, it will be easily seen how very obnoxious sand would be to his welfare. The worst of sand is that it is very liable to shift about in the sea, and great sandstorms not unfrequently occur, just as they do in the deserts of Arabia, destroying suddenly

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whole caravans of camels and men. When I was at the Isle of Ré, Dr. Kemmerer gave me a famous instance of a large number of oysters being destroyed by sand. This event happened at a place called Morique. There was a great number of tiles laid down at this spot, and there were, besides, a large number of oysters naturally adherent to the rocks. Just outside, however, there was a moving sandbank. The oyster spat had taken well, both on the tiles and on the stones, but during a storm the waves brought a quantity of sand, ruined the whole bed, and killed every oyster.

Although sand in large quantities is very dangerous to oysters, yet a certain quantity is by no means prejudicial to their welfare. The admixture should amount to what my friends at Ré call *sable vaseux*, or mud sand, which is very good for oysters, but it requires an experienced eye to know it when they see it.

Sand destroys oysters either by smothering them *en masse*, or by getting between the shell near the hinge, where the oyster cannot get rid of it. Frost, ice and snow are also destructive to oysters, but Buckland is of opinion that in all ordinary frosts, where the oysters are covered with three or four feet of water, they are safe.

By reading the above it will be seen that it is dangerous to place oysters on areas where the sand is continually shifting, for when the oyster opens to feed, the sand is drawn in between the valves of the shells, and it is unable to throw it out on account of its weight, consequently it dies. Any person thinking of cultivating oysters should first ascertain whether the area in question is suitable and the question can be settled just as easily by experimenting with a few as with a large quantity, and, in the event of failure, would save a large expense.

Mussels.

I must not omit to mention mussels as being one of the oyster's enemies. In some places, they are more so than others. They are the worst plague of the parcs at Oléron. They multiply there in such numbers that if the concessions are not visited and the mussels removed each time the tide allows it, they soon cover the ground in very thick masses.

I also remember an instance where mussels had spat on two oyster areas in Holland. One owner endeavoured to remove the mussels, letting the oysters remain, but the mussels grew faster than they could be cleared off, the consequence was that mud had accumulated to such an extent that the oysters were literally smothered, and what did live were thin and starved, and were a dead loss to the owner. The other area was cleared of its oysters with all possible speed, and the only loss incurred was the labour in removing the stock to more suitable grounds. On another occasion, a spat of mussels settled on the Whitstable Oyster Company's grounds; as soon as it was discovered, instructions were given to the men to remove all they possibly could, but, in the meantime, a vessel-load of starfish were deposited over the grounds to destroy them, as starfish will always take to what is most delicate and easy to get at; the mussels being very young at this time, were, with the aid of fivefingers and man, soon got rid of; the starfish were then in turn disposed of, by being caught in the dredge, or they would soon have attacked the young oysters, when they found that mussels were getting scarce.

Mussels increase and grow very fast, attaching themselves to any firm substance by means of a collection of horny threads (*bryssus*) with which they hold themselves in any one locality. Mud collects among their numbers and mud banks are often built by myriads of these shell-fish attaching themselves together. They thrive on muddy bottoms and become very numerous, they live on the same food as oysters, and when found in the same locality, the result is that the oysters are starved out.

The men at Arcachon say that there is not enough lime in the water for both the oyster and the mussels, and the latter being the stronger, they get all the lime, and the former suffer correspondingly. This is one way of expressing the general fact that somehow in the complex struggle for existence the mussels get on best.

Mud Digging.

Among other enemies, not only to the oyster, but to the beds and areas themselves, is the most destructive machine ever invented, this is the mud-digging machine.

I am not aware of such a practice ever existing, in any other portion of the globe, and yet within the last thirty years, millions of tons of mud have been removed, and thousands of acres of good oyster fishing areas have been destroyed. It is commonly called mussel mud, which, I think, often shields and protects it from further molestation; it chiefly consists of the shells of oysters, more or less decomposed, with mud that has settled in layers in the locality and mixed with the oysters; mussel shells are sometimes found, but not in the proportion that oyster shells are, or to even give it the name it bears. Some of these beds must have existed for ages, as the deposits are often found 20 and 30 feet deep, but when once the crust of the bed is broken, it has spolit the area for cultivating purposes.

These oyster fisheries, one of the great natural resources of our coastline and rivers, are a source of wealth by means of bringing ready cash to the fisherman, and to many others indirectly, and yet they are being gradually but surely destroyed by man. I am now speaking in favour of the oyster fisheries and the preservation of the beds, but I am afraid I may hit rather hard on some of the men who are in the habit of using mud; however, facts are stubborn things, and here I must clearly explain them.

The construction of this machine is composed of a substantial wooden frame-work of about eight feet in height, eleven feet wide and twenty-five or more long. At one end, on the upper part a block is attached through which a chain or rope is roved, one end being connected to a strong shovel, scoop, or bucket, with sharp heavy iron teeth on one side; this scoop is attached to a long stout staff or handle, varying from 15 to 30 feet long, by means of a hinge and a spring attached, for the purpose of emptying the contents of the bucket into sleighs, when raised to the surface. The handle is operated by one man, who places the scoop into position; this can be felt if it is placed correctly, by practice. The other end of the chain is connected to a windlass, which is fitted to the frame-work, and is so constructed that it can be worked by horse-power, one or more horses hitched to it. The scoop will hold about two bushels at a time, or thereabouts.

The idea is to place the digger upon the largest oyster area they can find when the ice is sufficiently strong to bear the weight of horses, sleighs, men and gear, &c.; digging for mud generally commences during the month of February, when other work is dull. The diggers will then commence to cut holes or trenches right through the entire length of an oyster bed, sometimes cutting to a depth of twenty, twenty-five, or even thirty feet, and from nine to fifteen feet in width. These holes will sometimes fill up in course of time with soft mud, or the sides of the cut will cave in, which totally destroys a large area of very valuable oyster ground, which can never be reclaimed, and is of little, if any use, to the oyster fishermen afterwards.

Thousands of acres of once valuable oyster ground have in this way been destroyed in our rivers and bays, and I regret to say this is not checked to the extent it should be. This system should be immediately stopped, as far as the fishermen are concerned, or I am very much afraid the day will soon come when our public oyster fisheries will be entirely ruined. This is one of my ideas in bringing before the notice of our readers, the reports of fishery officers of past years, when it clearly shows that the injury then done was more than noticeable. The following is taken from a Prince Edward Island fisheries report, dated 1873:—"During the past ten or twelve years, millions of tons of oyster shells and mud have been taken up by our farmers from oyster beds by means of dredging machines, worked by horses on the ice." In another report of 1888, an officer states that, "Oysters are protected by the fishery officers in summer, that they may be destroyed by the farmers in winter."

I will repeat no more on this subject, as the extracts I have collected and arranged in these pages can be perused at leisure. The deposit recovered from the deep by the farmers is placed upon their lands as a fertilizer, but whether this really does come up to their expectations I cannot say. I have heard them speak both in its favour and disfavour.

It would appear that in the view of agricultural experts that, while mussel mud forces a certain crop for a season or so, it really deteriorates the land to such an extent that it takes many years to bring it back to its former state by even putting on a larger supply and more expensive fertilizer. Be that as it may, I merely wish to point out the

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serious injury that is, and has been done, to the valuable oyster areas, which, if brought into a state of cultivation, would have rendered clean, firm and suitable grounds. If these machines had never worked upon the beds, the fishermen would enjoy to-day a much more extensive oyster area with more profitable results.

Before leaving this subject, I will mention one instance of an area which will fully bear out what I have already stated, it being an extract from the inspector's report of Nova Scotia, dated 1868, and is as follows :—I am informed that the local Government of this province (upon what authority I cannot say), granted a lease of certain oyster beds in Malagash Harbour to Alexander Macfarlane, Esq., of Wallace, for the purpose of cultivating oysters. The inhabitants generally are very much opposed to any such grant, as the mussel beds and the mud on the flats is invaluable for manure, and the granting of these privileges to Mr. Macfarlane has entirely deprived them of its use. I am not prepared at present to say whether the right to cultivate oysters may not be held by private individuals without interfering with the manure referred to. When the ice goes out in the spring I will be able to judge better. It is a matter of considerable importance, and very desirable to encourage, as far as possible, private enterprise in this as well as many other branches of our invaluable fisheries, and I have no doubt that oysters may be profitably cultivated, not only at Malagash, but Wallace, Tatamagouche and Pugwash as well. I hope the day is not distant when private enterprise will develop this branch of our natural resources to the advantage of the province, as well as to all concerned."

To-day the above-mentioned area, which was then leased to the Hon. Mr. Macfarlane, is now under cultivation by private individuals, and, had not the lease been granted in the first place, this valuable ground would have been the same as others, utterly destroyed by these mud-digging machines.

In 1885 I had the pleasure of visiting Tatamagouche Bay officially, my report, submitted to the department, was as follows :—

Malagash Bay.—The only place where oysters are found is situated in the basin at the head of Tatamagouche Bay on the west side. This area is comprised of several narrow streams or channels which are visible at low water, but at high tide a large extent of water is seen, which covers extensive mud flats, and are protected from the outside by spits or bars running out from both shores, leaving a very narrow channel to enter the basin, making the place almost landlocked. The bars on the north side, situated in Cumberland County, are called shipyard bars, which run off from Shipyard or Waugh's Island, and the bar on the south side in Colchester County is called Thrumpcap bar. There are also some small bars or ledges inside these bars, which dry at low water. These bars are covered on the top with small mussels, which are used to keep the bars from washing away; it is on these bars, among the mussels, that most of the oyster spat rests. The bars are natural spat collectors, and are literally covered with young oysters every fall, and unless they are picked from these ledges, they are killed by the severity of the winter, as the ice rests upon them and the frost kills them. I am informed that in the spring months, after the opening of navigation, scarcely an oyster is to be found until after the spatting season is over, when these beds or ridges glisten and sparkle like sheets of gold, the sun shining down on the semi-transparent shells of the oyster spat.

"The streams before referred to are nearly all taken up by leaseholders, very few oysters were in these streams until they were transplanted from the bars by the leaseholders. These men are interesting themselves in this industry, and I have every reason to believe they will become successful. Mud digging is generally carried on off Blockhouse Point on the east side of Tatamagouche Bay, and to the south of the bar leading to Tatamagouche River, where extensive oyster beds originally existed, but are now covered over with mud and eelgrass. Oyster mud is to be found here to last for ages, as the quantity taken is very small."

Twelve persons are now holding oyster license, for areas amounting to about seventy acres, and many others desire to have areas granted to them, which would not have been possible, had the farmers been allowed to dig mud. Many areas of once prolific oyster-yielding beds are now lying waste and totally unfit for cultivation in other localities, which might have been saved and utilized in the same way as Malagash Bay.

Under the heading of enemies, I have not included man's recklessness and unwise methods, although these are, perhaps, the most destructive of all agencies connected with the industry. Take the close season, for instance, there are men—impelled, we must suppose, by a mixture of improvidence, greed, recklessness and wilfulness, who persist in evading the regulations and restrictions with an ingenuity worthy of a better cause.

Overdredging or overfishing, which is only another way of saying the improvidence, or the cupidity, or perhaps even the stupidity of the arch-enemy, man. But the most difficult to deal with are thieves and pirates, who persist in poaching on all rich and well-stocked oyster beds. It is a cause of worry, annoyance and expense to those who own areas, but it is one of the things difficult to remedy.

Various other reasons might be quoted, such as removing small oysters from natural beds, and throwing them overboard, either at random or, worse still, leaving them on the shore to die and rot, after having separated them from the marketable ones.

Now, if we can all help the oyster every so little, so that these unfortunate molluscs shall have a somewhat better chance in the struggle for existence, we would soon see a change for the better.

Conclusion.

In this report I have collected numerous extracts relating to oysters from the fisheries annual reports, when it was then seen that further action should be taken to protect and enhance the value of this industry. This was done to corroborate what I have already said and to strengthen the reports made at the time of writing them. I have also, from time to time, made further references to them, as well as to other authorities on oysters. It will be found convenient to have this matter condensed in the form of a compilation for easy reference.

I have given a brief outline of the practical methods in some European countries and the United States, and have endeavoured to set forth a general idea of the work that may be safely carried on in the maritime provinces. For ages past, oysters have existed in our waters, and although they are not dying out naturally, yet with care and attention to this branch of the industry there is no doubt that this valuable bivalve may be increased, both in quantity and quality.

Before closing, I might make a suggestion for the future? It is, "private enterprise." The depletion and destruction of beds for the sake of immediate gain, with reckless disregard as to the future, demands serious attention; but let us hope that judicious enterprise, which may be slow at first, will make strides to repair the mischief and build up a lucrative industry.

The following table, which is more than sufficient to demonstrate the importance of the oyster industry in Canada, shows the whole catch for the respective provinces where this bivalve is found, for the last twenty-two years:—

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TABLE showing the Aggregate Quantities and Value of Oysters caught in the Dominion since 1876, compiled from Annual Reports
of the Department of Fisheries.

YEAR.	New Brunswick.		Prince Edward Island.		Nova Scotia.		British Columbia.		Totals.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Bds.	\$	Bds.	\$	Bds.	\$	Bds.	\$	Bds.	\$
1876.....	23,738	7,906	23,715	1,040	3,120	16,866	50,368			
7,911	20,850	62,520	20,850	2,940	21,562	88,704				
7,798	17,982	53,706	9112	2,754	30,160	94,270				
11,157	33,810	18,145	54,485	1,067	3,201	26,182	85,865			
1877.....	28,260	50,937	60,981	1,861	5,583	34,438	143,314			
1878.....	36,840	29,815	62,445	2,270	6,810	31,498	94,494			
1879.....	25,259	17,185	17,455	5,235	5,235	64,646	193,538			
8,413	17,042	116,640	1,343	4,029	1,343	50,540	151,629			
5,859	38,880	84,570	1,565	4,785	229	41,456	195,438			
10,317	35,553	28,250	1,310	3,930	250	1,250	171,886			
11,851	82,104	28,294	1,310	3,930	2,100	1,132	27,100			
1884.....	27,368	84,249	33,125	90,375	1,897	4,191	62,945	189,915		
28,083	106,196	63,588	36,448	106,344	1,716	5,148	61,360	187,340		
1885.....	49,152	35,861	107,588	1,589	4,767	3,500	3,500	163,307		
1886.....	16,394	41,257	123,771	2,132	5,250	5,250	5,250	169,349		
1887.....	17,720	53,280	165,609	3,013	9,039	7,040	7,040	171,778		
1888.....	50,130	44,802	123,090	4,318	12,750	3,000	61,402	188,446		
1889.....	16,710	44,894	14,090	4,318	12,554	7,500	3,000	153,553		
1890.....	53,820	52,957	98,811	3,776	11,228	4,000	167,639			
1891.....	17,840	49,065	29,627	3,488	10,464	1,600	8,000	156,440		
1892.....	16,385	67,840	24,055	96,220	5,312	10,049	1,600	45,137		
1893.....	16,960	25,463	101,682	2,540	10,160	1,600	8,000	47,673		
1894.....	18,070	72,280	120,856	2,440	9,640	1,200	4,800	194,256		
1895.....	14,700	58,900	30,214	2,372	9,486	1,000	8,000	44,722		
1896.....	19,835	79,340	20,915	83,690	1,000	8,000	180,486			
1897.....	338,264	1,069,357	644,465	2,034,017	45,82	14,570	62,560	1,038,111	3,317,364	
Total.....										

ANNEX A.

REPORT ON OYSTER CULTURE OPERATIONS DURING SEASON 1898, BY
DEPARTMENT EXPERT.

To the Honourable

Sir LOUIS H. DAVIES, K.C.M.G., &c.,

Minister of Marine and Fisheries, Ottawa.

OTTAWA, 31st December, 1898.

Sir.—I have the honour to submit my report for the season of 1898 on oyster culture. Having received instructions to proceed to Prince Edward Island, I was engaged in getting the gear in order for the work which followed.

On securing the services of a small steamer, I proceeded to Murray Harbour, and have been engaged nearly the whole time in removing the weed and eelgrass from an area which had been previously examined and reported upon as being a suitable bottom which could be converted into an oyster bed with the necessary labour; this area is situated to the north of Reynold's West Island, and is composed of firm sand and mud; this was very thickly covered with eelgrass, and by constant working, nearly the whole of the weed has been removed. After all the weed is cleaned off, it will be necessary to put a layer of gravel or fine stones and shells for a foundation, previous to laying the oysters for spawning and growing purposes. I have hopes that it will be converted into a good oyster bed. No oyster beds are located in this district, but occasionally a few oysters are to be found on the flats, and they are of fine quality and in very good condition, showing that if oysters were planted there is every reason to believe that they will grow. There is much speculation among the residents as to where these oysters come from. Some are of opinion there are beds which have not been located, while others seem to think the few oysters found are the refuse from the fishermen's own boats, which they clean out after returning from the oyster fishing season in the vicinity of Charlottetown and Orwell. Oysters originally existed in these waters, as will be seen by the deposits of dead shells which are annually dug up by the farmers, some close to where I have been preparing the grounds; this must be stopped here or they will encroach on the area already set apart for oyster culture. They also dig mussel mud in Fox, Greek and Murray Rivers. These areas are shallow, and have been dug upon by the farmers for years past, and are now of no use whatever for oyster culture.

RICHMOND BAY, P.E.I.

After the opening of the fishing season, I visited Richmond Bay and adjacent waters, making a general inspection over the whole area.

In Malpeque Bay oysters were reported scarce, the general average catch did not come up to a barrel a man per day; there were not more than a dozen boats fishing in the above locality, with the exception of some Indians fishing around Indian and Curtin Islands, most of them were engaged in picking the oysters from the shores, wading into the water until nearly waist-deep at low-water time.

On the north-western part of the bay, around Bideford, Narrows, Trout River and Lennox Island, oysters are also found to be getting scarcer, although there are more boats fishing; the sample brought on shore for market is good and of fair size, as the merchants or buyers here will not take small oysters, and the fishermen are beginning to see the result of leaving the small ones on the beds. These men will commence fishing, and after finding the oysters are getting scarce where their boats are moored, will sit down and cull their oysters over, the marketable ones are placed on one side, and any small ones that are taken into the boat attached to larger ones, are separated by means

of a sharp blow from either the back or blade of a small hatchet, usually carried for the purpose of separating clusters of oysters; the small ones are then returned to the water, and a fresh place is then selected to commence fishing again. This is carried on until the men are satisfied with their day's work, or are compelled to return to land through bad weather; the above is a decided improvement upon the system of culling and separating their oysters above high-water mark, where the young are left to die and decay. It would improve the oyster industry if this regulation were rigidly enforced by the fishery officers around the whole coast line where oysters exist. Small oysters were reported plentiful, and this is a good and healthy sign.

In Grand River, the sample of oysters taken from the lower part are very fine, both as regards quality and size, but higher up the oysters are found to be much smaller; several small oysters were lying along the shore where the boats landed, they looked as if they were the refuse of their catch. These small ones should have been replaced on the beds, as they will evidently die along the shores when once the winter sets in.

On the northern portion of Richmond Bay, abreast of Curtain Island, the oysters are of a very fine quality and of large size; they are taken from deep beds, and are becoming very valuable, as I saw them sold to buyers afloat at \$4 per barrel. Large oyster beds are found in this locality in deep water (from 20 to 26 feet), where it is almost impossible to use tongs on account of the depth and current of the tides. I cannot see that dredging in moderation does any harm to these beds, but would improve, cleanse and extend them if a limited time were given to dredge them to fishermen who choose to catch oysters by that method. Oyster beds that have been previously dredged upon in this locality are now covered with small oysters, the most noticeable are the Sand, or Long bed, and the Townsend, or 40-acre patch; both these beds are now covered with small oysters, too small for market, and several fishermen state that dredging is the cause of the spat settling there, as the shells have been raked over and cleansed. If the use of the dredge were allowed in this bay for a portion of each season, say from the 20th or 30th of October, when the weather becomes unsettled, till the close of navigation, then many a man could get a day's work by using dredges, where he could not catch an oyster with tongs. An imaginary line might be drawn from Gull Point, on the west side of the bay, to Beech Point, on the east side, allowing fishermen to dredge on the north of this line.

While visiting the boats, I found the sample of oysters taken to be of fair size, but if these oysters were left for another season they would make a splendid marketable oyster. Some of the men fishing had no license, and when asked, "why not," they stated they did not know where to obtain them from, as no one had been around with them.

On the shoals and flats between Curtain Islands, innumerable small oysters are found, but these do not mature, and I was informed that if I visited the place in the spring I should find the bulk of them had perished through the winter. These small oysters should be allowed to be picked for planting purposes, as they are easy of access, and no harm is done by granting permission to holders of licensed areas to restock their beds with small oysters from these flats and shores during the regular fishing season.

The oysters landed at St. Eleanor's were of a fair sample, many of them being just within the size limit, and yet scarcely fit for market. A fisherman appears to take no interest whatever in his future welfare, his only aim while fishing is to keep everything he catches in the shape of an oyster so that he will quickly fill a barrel; the quantity taken by each fisherman varied from one-half to a whole barrel.

It appears to me that a patrol boat is required the whole time, with a staff of sufficient force to inspect and enforce the regulations required, and see that no one fishes but those holding licenses and legal fishing appliances over this valuable area; also, that landing stations should be specified at different points, so that oysters should be landed only at such places as should be named or arranged with the principal buyers, or easy places of access, and that a warden should be on hand to inspect all boats as they land their oysters daily. If any small ones are brought on shore, such officer might see that they are replaced on the beds by the person in whose possession they were found, instead of being thrown on the shore or near the packer's warehouse to die and rot; this would not cause a great deal of expense, and would prove a great benefit to the industry.

TRACADIE, N.S.

On visiting the grounds at the above place, I found that they were clean, and the oysters had grown thicker and larger. I also noticed a slight percentage of dead ones amongst them ; this result I attribute chiefly to the rough usage the oyster had received from the time it was caught until relaid, as in nearly every case I noticed the shells of the dead oysters were chipped. They were transplanted while the oysters were growing, the shells being very tender and delicate at the time. The flesh of the oysters was very good, and of a much more salty flavour than those taken from the north-west arm. I was unable to find any trace of this year's spat ; that might be on account of the rainy and wet weather that prevailed in this locality during the spatting season, also, to the limited time I was there ; as the weather was very wild during my stay, I was unable to make an extensive examination to see if any spat had settled on any other parts of the bay, but, taking everything into consideration, the grounds were in a satisfactory condition.

CLOSING PUBLIC AREAS.

My attention has been called to several public oyster fishing areas which, of late years, have had a decided falling off in the catch ; this I attribute chiefly to the over-fishing of these grounds, the demand is now becoming much greater than the supply, and the increase in the number of fishermen who catch oysters is owing principally to the increase in price giving them more energy to work on the beds, even if under more trying circumstances. The consequence is that the beds are now becoming denuded of oysters, and before the oysters have attained a marketable size or age, they are caught and the beds have no time to recover. Fishermen can see this, but cannot prevent it themselves, and it would be advisable, in the interests of the industry, to close down certain areas for a limited time, say, if only for one or two years, it would be found to be of advantage to the fishermen, for when they did commence fishing on an area that had been closed they would have something to catch, as the oysters would be full grown. Clyde River and Long Creek might be reserved alternately each year ; then Mill Creek, Johnson's River and Pownall Bay ; in fact, many such areas might be closed down on the Island ; areas, also, in New Brunswick and Nova Scotia might be regulated in the same way, and I am sure if this matter were given serious thought and carried into effect it would give a fresh start to the industry and keep prices in good shape, as there would be something worth sending to market ; otherwise, the natural growth of the oyster on public beds is not sufficiently fast to supply the demands which increase each year, and the beds must ultimately collapse, through being overfished.

PRIVATE AREAS.

The safest and most valuable scheme for the preservation of the oyster in the maritime provinces is to encourage private culture. Interest has already awakened, and it is seen that, although in its infancy, it will develop into a large undertaking in the near future, already between 1,100 and 1,200 acres of ground have been taken up in Dominion waters, while other applications have been also made. Men who have launched into this enterprise can see the necessity of continuing the same for the maintenance of the oyster, and when properly managed, it is found to be a profitable industry. Persons in the oyster business, and having a piece of ground, find it invaluable for keeping their stock until they find a firm market : these persons can afford to be more particular in their culling as they can return all immature oysters to their beds ; these can lay and develop into larger oysters, giving a profit, if only in the growth alone, where oysters are sold by the measure ; it is especially so with those who buy from the ordinary fishermen, when so many small ones are to be found when culling them over for market. On obtaining possession of an area for the purpose of putting it into a state of cultivation, the beds may be stocked by picking or catching small oysters from the ordinary beds ; there has been some objection to this, as it is reported to deplete the natural beds, but

there are several places where oysters may be picked on the ~~bb-dries~~ and shallows, which, if they are not removed are inevitably lost, as they would perish with the winter's frosts. It must also be borne in mind that the taking up of private areas in the lower provinces for the cultivation of oysters is of very recent date, and that no areas are leased where oysters exist, and persons who take up these areas are not thoroughly acquainted with oyster culture in all its branches, it is only fair to give these pioneers in oyster culture a start that will encourage them to keep it up after they once worked their way into it.

The oyster industry of this Dominion has been purely taking advantage of a natural resource and it has had many things to hinder its success. In the past a great many more small oysters have been destroyed above the high water mark and at the doors of packers' warehouses than have ever been relaid by persons having licensed areas; then, again, mud digging has destroyed many oysters, as well as brood and valuable soil which can never be reclaimed, fishing in close season and through the ice has had also its ill effects; but I am in hopes that with the combined efforts of fishery officers, regulations and leased areas the oyster industry may yet be able to hold its own. It is far preferable for a few barrels of oysters to be transplanted on an area where no oysters exist, and see that they are being watched and cared for than to see heaps of bleached shells piled up on the shore, the cullings and young oysters which were too small for market left to decay.

In allowing persons to take up areas on depleted beds or other grounds they may choose, and stocking them with young and full-grown oysters, it must not be forgotten that these persons have no control whatever over the spat, and may be the means of restocking many natural beds which are in the vicinity of the leased ones, and I consider it of very great importance to grant licensed areas when not interfering with the public fishery.

The demand for oysters is now really greater than the supply, and the greater the number of resources there are in the different localities the better it is for the public generally, through the spat having a larger area to spread itself and strongly advise the encouragement of private culture, as it will eventually be the only means of keeping up and maintaining a supply.

OYSTER AREAS OF THE PROVINCES.

The oyster areas of the maritime provinces are numerous, situated, as they are, in the indented bays and rivers of the coast, from Baie des Chaleurs to, and including, the islands of Prince Edward and Cape Breton. Most of these areas have been examined and reported on, as may be seen by referring to the annual reports on oyster culture. There is still a large area of ground to be covered, the Caraquet beds have not been examined, and other areas along the New Brunswick shore; Cape Breton also has some oyster ground which has not yet been gone over; also, the north side of Prince Edward Island. I have just heard from Mr. W. C. Hobkirk, fishery officer for the Island, that an extensive bed of oysters has been discovered at Savage Harbour, about a mile long, and that the oysters caught are good and plentiful, while another is reported in Tracadie, but no particulars have been given. It is also desired that steps should be taken to examine the waters on the Bay of Fundy shores, and make some experiments as to the advisability of forming oyster beds there.

No efforts have ever been made by this department to ascertain whether any deep-water oysters exist in the sea around the coasts. On the north side of Prince Edward Island, with northerly gales of wind, oyster shells are reported to wash ashore, which would lead one to believe that oyster beds do exist outside; the same has also been reported of Buctouche, N.B.

Oysters and scallops are found in the English Channel and North Sea, in depths varying from ten to thirty fathoms water, and there is no reason why oysters should not be found along our own shores, where so many bays and rivers which contain oysters discharge their waters into the gulf.

OYSTER FISHING—ITS METHODS.

Various ideas have been formed with regard to the easiest and most advantageous mode of fishing oysters, and the implements used are many, a description of which will be given below.

Dredges are about the only implement used in Europe; they are also used to a great extent in the United States, but are very little used in the Dominion, although a very necessary machine, where areas require cleaning, and on cultivated areas they are most economic in the saving of time and labour. They are made of various sizes for the different localities where they are worked, some are made to be worked by hand, others are hove up by a hand winch, and in some cases a steam winch is used. On shallow bottoms the former is mostly worked.

A full description of this implement will be found in the special oyster report, page 330.

The nets of these dredges are often made of iron links for the lower part or back, as there is considerable wear as it is dragged over the bottom, while the upper portion of the net is made of a lighter material, such as twine, and the action of the water through the meshes keeps the net in an open position.

Tongs are used in many parts of the United States, and chiefly in Prince Edward Island; it is formed of two rakes, joined together with a bolt so arranged that both handles will work easily about one-third the length of the handle from the rake; it varies in size and length of handles according to the depth of water it is used for, the average length of handle being 14 or 16 feet long, the width of rake about 30 inches, where curved iron teeth, about 3 inches long, and one and a half inches apart are fixed; when working with the tongs the boat is moored over an oyster bed, and moved about from time to time, as required; the tongs are then used on the bottom, and collects oysters and weed, which may lay in its way while being drawn together; on raising the tongs to the surface, the contents are culled out, saving the oysters, while the shells are returned to the water, where they settle on the bottom, as the tide carries them. A man can take a small row-boat and pair of tongs and is enabled to go where he pleases to fish, while dredges require a heavier boat, with sails, &c.

The single-handled rake, a rude and destructive implement, is used where the bottoms are softer, and also from an open boat, moored. This varies in size, the rake is about 30 inches wide, with curved teeth, from 8 to 10 inches in length, and arranged about one and a half inches apart, with a handle from 15 to 25 feet long; it will collect the shells and oysters from the bed all around into uneven banks, breaking through the crust of the beds, and doing more damage to a piece of ground than the good they reap by their catch; by this method the beds are continually becoming more contracted. An oyster area requires to be as even as possible, and where depressions are made on oyster beds, the sediment soon settles, making mud holes, where, eventually, the eelgrass will grow and the beds soon become covered over.

I have seen Indians use the flat eel spears bent round at right angles, making a hook of it, which they will fish among the rocks and ledges, and are expert in obtaining oysters by that method.

In Cape Breton an instrument called a dip-net is used. It consists of a circular or oblong band of iron about 8 inches in diameter, and when oblong will have a depth of 12 inches by 8; at the back or bottom of this is attached a small net, made either of wire or twine, and fixed to a pole about 10 or 12 feet long for a handle; when an oyster is seen from the boat it is scooped into the dip-net. The water is clear as a rule, the bottom being easily visible at a depth of 6 to 9 feet from the surface. At times when there is wind and it is difficult to see the bottom, some of the fishermen will sprinkle oil on the rough water around their boat enabling them to see the bottom more clearly. But the most crude of all was a split stick which was used in Cape Breton; the person using it will be looking over the boat's side and, on seeing an oyster, this pole, which is split at the lower end into four parts and slightly opened is thrust over the oyster, and when a firm hold is found to have been obtained, the stick is raised and the oyster extracted; it is a slow method, but these men obtain a very good sample of oysters, and no very

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small ones are obtained. It is seen from the above that all sorts of schemes are formed to remove the oyster from its bed, and very few persons are to be found who would lay any small oysters on these beds for development or improvement.

MUD-DIGGING AREAS.

Several applications were made by the farmers to have some alteration made in the mud-digging areas, and, in compliance with instructions, I have been over the East, West, North and Johnson's Rivers, have drawn fresh lines and limits, and reserved further areas for the use of oyster fishermen. The present arrangements are satisfactory to all parties concerned, and a copy of the metes and bounds has been left with the fishery officer in Charlottetown for future reference, the original having been placed on file in this department.

SIZE LIMIT.

My attention has been drawn to the size of some of the oysters shipped to market, and when speaking to the fishermen they state their oysters are within the size limit, as they claim these small oysters are round, whereas the round oyster belongs to Caraquette, and the following regulations were originally intended for those oysters only, but it is now made common use of wherever oysters are caught. Clause 6 of the oyster regulations reads as follows:—"No person shall fish for, catch, kill, buy, sell, or have in possession, any round oysters of a less size than two inches in diameter of shell, or any long oysters measuring less than three inches of outer shell." I would strongly advise that this regulation should be altered so as to read as follows:—"No person shall fish for, catch, kill, buy or sell any oysters measuring less than three inches of outer shell, with the exception of those taken from Caraquette and the waters of Gloucester County. Three inches of shell will give a very small oyster, and that size is the lowest limit that it is possible to give to be of any benefit or value to the industry.

I have the honour to be, sir,

Your obedient servant,

ERNEST KEMP, *Oyster Expert.*